2013 PROPOSED CHANGES TO THE INTERNATIONAL RESIDENTIAL CODE - BUILDING

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TENTATIVE ORDER OF DISCUSSION
2013 PROPOSED CHANGES TO THE
INTERNATIONAL RESIDENTIAL CODE – BUILDING

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation **does not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair. Note that some IRC code change proposals may not be included on this list, as they are being heard by other committees. Please consult the Cross Index of Proposed Changes.

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RB1 – 13
R101.2

Proponent: Steve Thomas, Colorado Code Consulting, LLC representing Colorado Chapter ICC (sthomas@coloradocode.net)

Revise as follows:

R101.2 Scope. The provisions of the International Residential Code for One- and Two-family Dwellings shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures.

Exceptions:

1. Live/work units located in townhouses and complying with the requirements of Section 419 of the International Building Code shall be permitted to be ~~built as one- and two-family dwellings or townhouses~~ constructed in accordance with the International Residential Code for One- and Two-Family Dwellings. Fire suppression required by Section 419.5 of the International Building Code when constructed under the International Residential Code for One- and Two-family Dwellings shall conform to Section P2904.
2. Owner-occupied lodging houses with five or fewer guestrooms shall be permitted to be constructed in accordance with the International Residential Code for One- and Two-family Dwellings when equipped with a fire sprinkler system in accordance with Section P2904.

Reason: Live/work units are regulated by Section 419 of the IBC. This exception has created enforcement problems for local jurisdictions as it applies to one- and two-family dwellings. The way the language is written, it creates serious enforcement problems for building departments. If a homeowner wants to open a home business in an existing home, this section would require them to sprinkler the home. The IRC only requires new homes to be provided with fire sprinklers. A contractor that uses their garage to store their tools or build cabinets would be classified as live-work units under this exception as well. Is that really what we want the code to say? This provision is over-restrictive and unenforceable for the building official. This proposal limits the use of the live-work provisions would only apply to townhouses.

Cost Impact: This will reduce the cost of construction.

RB1-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R101.2-RB-THOMAS

RB2 – 13
R102.7.1

Proponent: David Bonowitz, Chair, Existing Buildings Subcommittee, Code Advisory Committee, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

Revise as follows:

R102.7.1 Additions, alterations or repairs. Additions, alterations or repairs to any structure shall conform to the requirements for a new structure ~~without requiring the existing structure to comply with all of the requirements of this code, unless otherwise stated.~~ ~~Additions, alterations or repairs shall not cause an existing structure to become unsafe or adversely affect the performance of the building.~~ <u>Alterations and repairs shall be such that the existing structure is no less complying with the provisions of this code than the existing structure was prior to the alteration or repair. For additions, alterations to the existing structure shall be made so that the existing structure with the addition is no less complying with the provisions of this code than the existing structure was prior to the addition.</u>

Reason: This proposal updates the IRC language with respect to existing buildings, in coordination with the IBC and IEBC. It clarifies, but does not change, the current intent.

In general, the IRC (with or without Appendix J) is obsolete in its terminology and language regarding existing buildings. Especially regarding structural issues, its provisions continue to use terms and formulations that have long since been revised in IBC Chapter 34 and the IEBC Work Area method. (For examples, the term "unsafe" and the labels and definitions of project types in Appendix J.) This proposal does not seek complete uniformity with the other codes, but it does attempt to correct some obsolete language that is now prone to incorrect interpretation.

In the first sentence, the proposal clarifies the main purpose, which is to require the intended addition, alteration, or repair work itself to be as for new construction. The second half of the sentence is deleted, as it has been in IBC sections 3403.1 and 3404.1 and IEBC sections 402.1 and 403.1. The portion proposed for deletion is redundant, since the next sentence (either as is or as proposed) tells you when and how to consider the existing structure. It is also potentially confusing, since it incorrectly gives the impression that the only possibilities are either no upgrade or total upgrade of the entire building for "all of the requirements of this code."

The proposal replaces the second sentence in order to correct four problems with the current text:

- The proposal removes the word "unsafe." First, this term is redundant in R102.7.1, since any work that would make the building unsafe would certainly also "adversely affect the performance." Second, the IRC does not define "unsafe" and so relies on the IBC, but the IBC's definition is unorthodox, as it comes through the text of section 116.1, not through a formal definition. In any case, from a structural perspective, a building is unsafe when the structure is "dangerous" as defined in the IBC or IEBC, but that definition has in mind an extreme condition verging on collapse. We do not believe it is the intent of the IRC committee to allow structural modifications to dwellings that take them to a condition just shy of dangerous. (IRC Appendix J does have its own definition of dangerous, but section R102.7.1 must be able to stand on its own, since Appendix J will not necessarily be adopted. Besides, the Appendix J definition is obsolete as well and applies only to structural conditions.)
- It replaces the phrase "adversely affect the performance" with "no less complying" language consistent with IBC sections 3403.1 and 3404.1 and IEBC sections 402.1 and 403.1. The IRC is compliance-based, not performance-based, so vague reference to "performance" is not enforceable. More important, the "adversely affect" phrase suggests that the existing building cannot be made worse by any measure, a restriction more severe than is probably intended. That is, as long as the building still complies, some reduction in capacity should be allowed.
- It restates the provision as an enforceable instruction, not as a blanket prohibition. That is, provisions for existing buildings are more useful and effective when they say what must be done, not what is prohibited. The IBC and IEBC provisions have been revised and written with this approach since 2009.
- It separates the project types, where necessary. Here, the provisions for additions, alterations, and repairs do not vary much, but the proposal reorganizes the provision to set a precedent and make future revisions by project type easier. This is consistent with the 2009 revisions to IBC Chapter 34, the IEBC Work Area method and IRC Appendix J.

Cost Impact: None

RB2-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R102.7.1 #1-RB-BONOWITZ

RB3 – 13
R102.7.1

Proponent: David Bonowitz, Chair, Existing Buildings Subcommittee, Code Advisory Committee, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

Revise as follows:

R102.7.1 Additions, alterations ~~or~~, repairs, or relocations. Additions, alterations or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with all of the requirements of this code, unless otherwise stated. Additions, alterations ~~or~~, repairs, or relocations shall not cause an existing structure to become unsafe or adversely affect the performance of the building.

Reason: This proposal adds relocations to the list of possible project types applicable to existing dwellings. The IBC and IEBC recognize five project types: Additions, alterations, repairs, relocations, and changes of occupancy. Change of occupancy need not be included here since it is already covered in IRC section R110.2, but relocations are common, and the IRC should consider them.

The proposal modifies the section title and the last sentence. The first sentence is not modified because that sentence refers to projects that affect only part of an existing structure, whereas relocations affect the entire structure.

The intent of this proposal is not to negate, reverse, or otherwise interfere with any other proposal for this section. Any other approved proposal should be made. Then, this proposal, if approved, would merely add relocations to the list of project types.

Per R201.4, it should not be necessary to add a definition of relocation to the IRC. That term is also used in the IBC and IEBC without definition.

Cost Impact: None

RB3-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R102.7.1 #2-RB-BONOWITZ

RB4 – 13
R104.10.1, R105.3.1.1, R112.2.1, R112.2.2, R301.2.4, R322.1

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net)

Revise as follows:

R104.10.1 Flood hazard areas. The building official shall not grant modifications to any provisions related to flood hazard areas as established by Table R301.2(1) ~~without the granting of a variance to such provisions by the board of appeals~~ unless a determination has been made that:

1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section R322 inappropriate.
2. A determination that failure to grant the modification would result in exceptional hardship by rendering the lot undevelopable.
3. A determination that the granting of a modification will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. A determination that the modification is the minimum necessary to afford relief, considering the flood hazard.
5. Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.

R105.3.1.1 Determination of substantially improved or substantially damaged existing buildings in flood hazard areas. For applications for reconstruction, rehabilitation, alteration, repair, addition or other improvement of existing buildings or structures located in a flood hazard area as established by Table R301.2(1), the building official shall examine or cause to be examined the construction documents and shall make a determination ~~prepare a finding~~ with regard to the value of the proposed work. For buildings that have sustained damage of any origin, the value of the proposed work shall include the cost to repair the building or structure to its predamage condition. If the building official finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure before the damage has occurred or the improvement is started~~, the finding shall be provided to the board of appeals for a determination of substantial improvement or substantial damage. Applications determined by the board of appeals to constitute substantial improvement or substantial damage~~ the proposed work is a substantial improvement or restoration of substantial damage and the building official shall require all existing portions of the entire building or structure to meet the requirements of R322.

For the purpose of this determination, a substantial improvement means any repair, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. If the building or structure has sustained substantial damage, all repairs necessary to restore the building or structure to its pre-damaged condition are considered substantial improvement regardless of the actual repair work performed. The term does not include:

1. Improvements of a building or structure required to correct existing health, sanitary or safety code violations identified by the building official and which are the minimum necessary to assure safe living conditions; or
2. Any alteration of a historic building or structure, provided that the alteration will not preclude the continued designation as a historic building or structure. For the purposes of this exclusion, a historic building is:
    2.1. Listed or preliminarily determined to be eligible for listing in the National Register of

Historic Places; or

2.2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or

2.3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

~~**R112.2.1 Determination of substantial improvement in flood hazard areas.** When the building official provides a finding required in Section R105.3.1.1, the board of appeals shall determine whether the value of the proposed work constitutes a substantial improvement. A substantial improvement means any repair, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. If the building or structure has sustained substantial damage, all repairs are considered substantial improvement regardless of the actual repair work performed. The term does not include:~~

1. ~~Improvements of a building or structure required to correct existing health, sanitary or safety code violations identified by the building official and which are the minimum necessary to assure safe living conditions; or~~
2. ~~Any alteration of a historic building or structure, provided that the alteration will not preclude the continued designation as a historic building or structure. For the purposes of this exclusion, a historic building is:~~
   - ~~2.1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places; or~~
   - ~~2.2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or~~
   - ~~2.3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.~~

~~**R112.2.2 Criteria for issuance of a variance for flood hazard areas.** A variance shall only be issued upon:~~

1. ~~A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section 322 inappropriate.~~
2. ~~A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.~~
3. ~~A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.~~
4. ~~A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.~~
5. ~~Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.~~

R301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1), and substantial improvement and restoration of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions of Section R322. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1), and substantial improvement and restoration of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions contained in this section. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

Reason: This proposal does three things related to existing dwellings in flood hazard areas:

1. Moves language from R112.2.2 to R104.10. The effect is to parallel both the IBC and IEBC which charge the building official with making certain determinations before granting modifications, rather than have the Board of Appeals make such determinations.
2. Moves language from R112.2.1 to R105.3.1.1. The effect is to more closely align the IRC with the IBC and IEBC, which rely on the building official to determine whether work on existing buildings in flood hazard areas meets the definitions "substantial improvement" and "substantial damage," rather than have the building official make a finding and have the Board of Appeals make such determinations
3. Clearly identify in R301.2.4 and R322.1, that the flood provisions apply to substantial improvement and substantial damage; R102.7.1 already makes clear that the IRC applies to additions, alterations, or repairs.

The IRC currently requires the Board of Appeals to do two things that are done by the building official under both the IBC and the IEBC – (1) determine whether requests for modifications to the flood provisions meet certain criteria and (2) determine whether work on existing dwellings constitutes substantial improvement or substantial damage (SI/SD). As stated in R112.1, the purpose of a Board of Appeals is to hear appeals of decisions, orders, and determinations of the building official. If the Board is charged with making decisions, such as the granting of a modification (variance) and the determination of SI/SD, then permit applicants and permittees have no recourse to appearl those decisions, except perhaps the courts. If building officials are capable of making these determinations under IBC and IEBC, then they should be permitted to do the same under the IRC.

The proposed changes to R301.2.4 and R322.1, which have the same phrasing, is to make clear that, as stated in R102.7.1, because the IRC applies to work on existing dwellings, the flood provisions apply to substantial improvement and substantial damage of existing dwellings. The added phrase is the same as used in IBC 1612.1.

Cost Impact: Costs will be reduced for permit applicants and permittees who challenge SI/SD determinations and decisions on requests for modifications (variances) because they can appeal the building official's decisions to the Board of Appeals instead of the courts. There is no change in the cost of compliance because the IRC already applies to existing dwellings and communities that participate in the NFIP have long required existing buildings that are SI/SD to be brought into compliance with the requirements for new construction.

RB4-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R104.10.1-RB-QUINN-WILSON

RB5 – 13
R105.1

Proponent: Joseph D. Belcher, JDB Code Services, Inc, representing the International Hurricane Protection Association (joe@jdbcodeservices.com)

Revise as follows:

R105.1 Required. Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any <u>impact protective system</u>, electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make application to the *building official* and obtain the required *permit*.

Reason: Opening protection by impact protective systems is an important aspect in maintaining structural integrity during a hurricane event. In addition to increasing the structural performance of buildings, they play a role in the life safety of the people weathering the storm out in their residence. Observations in the field reveal many installations do not meet the standards adopted for these devices as became apparent during storms in recent years. Unfortunately, many jurisdictions do not require permits or inspections for these important structural safeguards and life safety devices because they are not addressed in the section of the code addressing required permits. With the emphasis of emergency management shifting to defending in place due to the inability of the infrastructure to handle mass evacuations, these impact protective systems, be they impact rated glass or devices, and their proper installation becomes even more important.

The hurricane protection industry estimates annual sales in unapproved and mostly bogus “hurricane protection devices” at $30M to $40M at the minimum. These products have not been tested or investigated by anyone and meet no standards. The sellers of these products target citizens and give residents a false sense of security. Requiring permits and inspections for all impact protective systems would dramatically increase the protection provided to the residents of single family dwellings.

Cost Impact: The proposal may result in a slight increase for the cost of a permit solely for projects involving installation, alteration, repair or replacement projects. For new construction there should be no cost as the permit for the building would include the installation of the impact protective system. The benefit of the requirement, however, will far outweigh any added cost in permitting by increasing the assurance that these important structural and life safety protection devices are properly designed and installed. The industry has noted cases of substandard materials, inappropriate testing or claims of testing, and improper installation of products. We believe closer scrutiny of the design and installation of these important property protection and life safety systems will result in greater protection to the public and a better value to the consumer.

Staff Analysis: Mr. Belcher has a companion change for a new Section 614 that has criteria for impact protective systems. Requirements for these types of systems are in the IRC in Section 301.2.1.2 and 612.6.

RB5-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R105.1-RB-BELCHER

RB6 – 13
R105.2

Proponent: Rick Davidson, City of Maple Grove, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R105.2 Work exempt from permit. *Permits* shall not be required for the following. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*.

Building:

1. One-story detached *accessory structures* used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed 200 square feet (18.58 m^2).
2. Fences not over 7 feet (2134 mm) high.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. Sidewalks and driveways.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
8. Swings and other playground equipment.
9. Window awnings supported by an exterior wall which do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
10. Decks ~~not exceeding 200 square feet (18.58 m^2) in area,~~ that are not more than 30 inches (762 mm) above *grade* at any point~~, are not attached to a *dwelling*~~ and do not serve the exit door required by Section R311.4.

Reason: This proposal deletes certain provisions of the exemption for decks. 200 square feet is an arbitrary limit and without basis. If a jurisdiction wishes to limit the size of a deck, they may do so through their local zoning regulations. There is nothing unique about these structures that make a deck that is 210 square feet in area more dangerous than one that is 190 square feet.

Furthermore, whether or not it is attached to the dwelling should make no difference. It is common practice to set these low decks adjacent to the dwelling and often homeowners wish to attach them to the dwelling for added stability. Why would we want to discourage them from making their deck more secure by requiring a permit? All too often the regulations start to get pretty restrictive regarding the connections for these low decks. The owner may wish to add a few lag bolts to stabilize the deck or they may wish to support one entire length of the deck from the house.

The risks posed do not warrant the close regulations that permitting requires. Building department resources are stretched thin. Permit fees on these decks rarely cover the cost of enforcement. Public dollars can be better spent on more significant projects.

A common argument for requiring permits for these structures is for zoning compliance. That is a lousy reason for requiring a building permit. Local zoning ordinances often regulate other structures when a building permit is not required. Certain fences, arbors, trellises, and small accessory structures come to mind. Let the zoning folks carry their own water.

Cost Impact: None

RB6-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R105.2 #1-RB-DAVIDSON

RB7 – 13
R106.1.1, R106.1.3 (New)

Proponent: Michael D. Fischer, Kellen Company, representing the American Institute of Building Design (mfischer@kellencompany.com)

Revise as follows:

R106.1.1 Information on construction documents. *Construction documents* shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *building official*. *Construction documents* shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the *building official.* ~~Where required by the *building official*, all braced wall lines, shall be identified on the *construction documents* and all pertinent information including, but not limited to, bracing methods, location and length of braced wall panels, foundation requirements of braced wall panels at top and bottom shall be provided.~~

R106.1.2 Manufacturer's installation instructions. Manufacturer's installation instructions, as required by this code, shall be available on the job site at the time of inspection.

<u>R106.1.3 Information on braced wall design.</u> <u>For buildings and structures utilizing braced wall design, and where required by the *building official*, all braced wall lines shall be identified on the *construction documents*. All pertinent information including, but not limited to, bracing methods, location and length of braced wall panels, foundation requirements of braced wall panels at top and bottom shall be provided.</u>

Reason: The code contains confusing language regarding braced wall design, and suggests the building official is the one who "requires" braced wall design. It seems to us the intent of the code provision is to specify the necessary detail for those projects where the building official requires they be included in the construction documents. This proposal seeks to satisfy that intent and clear up the confusion. Additionally, R106.1.1 contains general information regarding the media used; this technical detail rightfully belongs in its own section.

Cost Impact: None.

RB7-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R106.1.1-RB-FISCHER

RB8 – 13
R106.1.4 (New), R702.8 (New), R703.13 (New); Chapter 44, AJ301.1.1.1 (New), AJ701 (New)

Proponent: Rebecca Morley, representing National Center for Healthy Housing

Add new text as follows:

IRC SECTION R106
CONSTRUCTION DOCUMENTS

R106.1.4 Certifications and plans where painted surfaces are disturbed. Where a dwelling was completed prior to 1978 and repair, alteration or addition being performed will result in the disturbance of painted surfaces, the contractor shall provide to the code official one of the following:

1. Copies of EPA or state renovation firm certification, renovator certification and a plan for compliance in accordance with 40 CFR 745 requirements for renovations.
2. Documentation from an approved test in accordance with 40 CFR 745.82(a)(1) or (2) that shows that the disturbed paint contains lead that is below specified levels.

IRC SECTION R702
INTERIOR COVERINGS

R702.8 Disturbance of existing painted surfaces. In any dwelling completed prior to 1978, repairs, alteration and additions where painted surfaces are disturbed shall comply with the information distribution, certification and work practice requirements of 40 CFR 745 for renovations.

> **Exception:** Where documentation is provided from an approved test in accordance with 40 CFR 745.82(a)(1) or (2) that proves that the disturbed paint contains lead levels below specified levels, the work is not required to comply with this section.

IRC SECTION R703
EXTERIOR COVERING

R703.13 Disturbance of existing painted surfaces. In any dwelling completed prior to 1978, repairs, alteration and additions where painted surfaces are disturbed shall comply with the information distribution, certification and work practice requirements of 40 CFR 745 for renovations.

> **Exception:** Where documentation is provided from an approved test in accordance with 40 CFR 745.82(a)(1) or (2) that proves that the disturbed paint contains lead levels below specified levels, the work is not required to comply with this section.

CHAPTER 44
REFERENCED STANDARDS

EPA
U.S. Environmental Protection Agency

40 CFR 745-July 1, 2012 Lead-Based Paint Poisoning Prevention in Certain Residential Structures

SECTION AJ301
REPAIRS

AJ301.1.1.1 Disturbance of existing painted surfaces. In any dwelling completed prior to 1978, repairs, alteration and additions where painted surfaces are disturbed shall comply with the information distribution, certification and work practice requirements of 40 CFR 745 for renovations.

> **Exception:** Where documentation is provided from an approved test in accordance with 40 CFR 745.82(a)(1) or (2) that proves that the disturbed paint contains lead levels below specified levels, the work is not required to comply with this section.

SECTION AJ701
REFERENCED STANDARDS

EPA
U.S. Environmental Protection Agency

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures

Reason: This code change proposal is to incorporate protection from lead-based paint by specifying (1) that additions, alterations, and repairs to pre-1978 homes comply with federal health-protective requirements to protect children from lead poisoning and (2) that permit applicants include, with the other construction documents, evidence of compliance.

The purpose of this proposed code language is to incorporate protection from lead-based paint into the Code through the requirement for construction documents. Once the Code requires permit applicants to demonstrate up front their knowledge of, and plans to follow, the federal and state renovation rule requirements, the code official will be positioned to provide important oversight and leadership in preventing lead poisoning without even leaving the office. This oversight will help level the playing field between contractors who are complying with the rule and noncompliant entities who are under-pricing and undercutting their competitors. By merely asking an applicant for the missing documents, the code official can influence entities not following the law into compliance before the work even starts. In a few cases, these entities may be unaware of the regulations. Although these regulations have been in effect since April 2010, and have been adopted by 12 states, reported non-compliance is affecting the compliant contractor and continuing the problem of lead poisoning in the US.

The proposed “plan for compliance in accordance with 40 CFR 745 requirements for renovations” with the federal disclosure and work practice requirements” can take different forms depending on what documents the builder is already using. Some builders who work on pre-1978 homes are already using a form to track their upfront assessments and another form for recordkeeping. Anyone working in pre-1978 homes should have an EPA or state certification for their firm, along with at least one individual renovator certification that the renovator received at the end of the required one-day training course. These requirements are already in effect in federal and state regulation.

The plan and certifications would only be needed for a structure likely to contain lead-based paint: a pre-1978 home. As noted under the exception, the requirement is waived if paint testing proves that the paint is not lead-based paint. A rebuttable presumption of lead’s presence allows the builder to demonstrate that lead is not present and obtain exemption from the requirements. EPA-approved tests include lead-based paint inspection or risk assessment, test kit used by a certified renovator, and collection of a lead-based paint chips for laboratory analysis.

Renovation of painted surfaces is a significant source of lead dust that poisons children. The dangers associated with lead poisoning are well-known: serious health effects, detrimental effects on cognitive and behavioral development, with serious personal and social consequences that may persist throughout their lifetime.

Multiple studies have demonstrated that lead dust is the major source of lead poisoning for young children. There is no safe level of lead exposure for children; lead affects intelligence even at very low levels.[1,2,5,8,9] Indeed, the rate of IQ loss per 1 microgram of lead per deciliter of blood (μg/dL) is greatest at lead levels below 10 μg/dL. As a child’s BLL increases from 1 to 10 μg/dL, experts estimate a child may lose anywhere from 3.9 to 7.4 IQ points, but from 10 to 30 μg/dL the decrement is 2.5 to 3.0 IQ points. Low-level chronic exposure may have an even greater effect on IQ than a single instance of very high BLL.[10]

Research indicates that a five-point negative shift in IQ at the population level would increase the number of children with an “extremely low” IQ by 57%, substantially increasing the cost of special education programs.[3] Considering the costs to the special education system alone, one study conservatively estimated that it costs $38,000 over three years to educate a child with lead poisoning.[11] Low-level exposure to lead has also been linked to factors other than IQ that can further impact educational outcomes. EBLLs are associated with Attention Deficit Hyperactivity Disorder (ADHD) and antisocial behavior, which in turn increase the likelihood of conduct disorder, criminal activity, and drug abuse.[1,4] Each 1 μg/dL reduction in the average preschool blood lead level saves $13.4 billion from the direct and indirect costs of crime.[1]

Several recent studies have explored the specific effects of lead on educational outcomes. These studies show a strong relationship between slightly elevated blood lead levels in young children and decreased scores on end-of-grade tests in elementary school. While similar educational effects were documented for higher blood levels decades ago,[12] the recent studies confirm that the connection between blood lead and poor educational outcomes remains true for blood levels as low as 3-4 μg/dL. A more recent study of 57,000 North Carolina children found that children with a BLL as low as 4 μg/dL at three years of age were significantly more likely to be classified as learning-disabled than children with a BLL of 1 μg/dL.[6]

The consequences of lead exposure are clear. This code change proposal seeks to reduce the risk of lead exposure during and after work performed on a pre-1978 home – and level the playing field among contractors working on pre-1978 properties.

The EPA 40 CFR 745 standard is available at http://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol32/xml/CFR-2012-title40-vol32-part745.xml.

References:

1. Gould E. Childhood lead poisoning: conservative estimates of the social and economic benefits of lead hazard control. Environ. Health Perspect. 2009;117(7):1162–1167.
2. Jusko TA, Henderson CR, Lanphear BP, Cory-Slechta DA, Parsons PJ, Canfield RL. Blood lead concentrations. Environ. Health Perspect. 2008;116(2):243–248.
3. Mazumdar M, Bellinger DC, Gregas M, Abanilla K, Bacic J, Needleman HL. Low-level environmental lead exposure in childhood and adult intellectual function: a follow-up study. Environ Health. 2011;10:24.
4. Chandramouli K, Steer CD, Ellis M, Emond AM. Effects of early childhood lead exposure on academic performance and behaviour of school age children. Arch. Dis. Child. 2009;94(11):844–848.
5. Miranda ML, Kim D, Galeano MA, Paul CJ, Hull AP, Morgan SP. The relationship between early childhood blood lead levels and performance on end-of-grade tests. Environ. Health Perspect. 2007;115(8):1242–1247.
6. Miranda ML, Maxson P, Kim D. Early childhood lead exposure and exceptionality designations for students. Int J Child Health Hum Dev. 2010;3(1):77–84.
7. Advisory Committee on Childhood Lead Poisoning Prevention. Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention. 2012:1–68. Available at: http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_030712.pdf. Accessed March 6, 2012.
8. Lanphear BP, Hornung R, Khoury J, et al. Low-level environmental lead exposure and children's intellectual function: an international pooled analysis. Environ. Health Perspect. 2005;113(7):894–899.
9. Canfield RL, Henderson CRJ, Cory-Slechta DA, Cox C, Jusko TA, Lanphear BP. Intellectual impairment in children with blood lead concentrations below 10 microg per deciliter. N. Engl. J. Med. 2003;348(16):1517–1526.16.
10. Lanphear BP, Dietrich K, Auinger P, Cox C. Cognitive deficits associated with blood lead concentrations. Public Health Rep. 2000;115(6):521–529.17.
11. Korfmacher KS. Long-term costs of lead poisoning: How much can New York save by stopping lead? Rochester, NY: University of Rochester; 2003.
12. Needleman HL, Leviton A, Bellinger D. Lead-associated intellectual deficit. N Engl J Med. 1982; 306(6):367.

Cost Impact: This code change proposal will not increase the cost of construction.

Staff analysis: A review of the standard proposed for inclusion in the code, EPA 40 CFR 745-July 1, 2012, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB8-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R106.1.4 (NEW)-RB-MORLEY

RB9 – 13
R109.1.4.1 (New)

Proponent: Andrew Herseth, US Dept of Homeland Security, Federal Emergency Management Agency (FEMA); Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

<u>**R109.1.4.1 High wind region sheathing inspection.** Where wind design is required in accordance with Section R301.2.1.1, inspection of the roof sheathing, wall sheathing and sheathing fasteners shall be made after all roof sheathing, wall sheathing and sheathing fasteners are in place. The sheathing inspection shall be permitted to coincide with the frame inspection, and shall be made prior to the dry-in inspection.</u>

Reason: The purpose of this proposal is to ensure design-intended performance of roof and wall sheathing in hurricane prone regions by requiring inspection to verify those elements are installed as specified. As summarized in Fact Sheet 1.1 of FEMA P-499, *Home Builder's Guide to Coastal Construction* (FEMA, 2010), "construction inspections and quality control are essential for building success (as even) "minor" construction errors and defects can lead to major damage during high-wind or flood events." The need for roof and wall sheathing inspection is supported by post-disaster investigations. Numerous FEMA-sponsored MAT observations have documented failed sheathing installations resulting from inadequate connections to framing, as shown on pages 4-58 (wall) and 4-59 (roof) of *Hurricane Katrina in the Gulf Coast* (2006, FEMA). Hurricane Recovery Advisory No. 1 from FEMA 488, *Hurricane Charley in Florida* (2004), further identifies the verification of proper roof sheathing attachment as a key issue in the installation of roof underlayment in hurricane-prone regions. Failed sheathing attachments can lead to water intrusion, loss of roof structure, and wall collapse.

Cost Impact: The code change proposal will not increase the cost of construction since inspections will be through building code official.

RB9-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R109.1.4.1 (NEW)-RB-HERSETH-OVERCASH

RB10 – 13
R202

Proponent: Tim Pate, City and County of Broomfield, CO, representing Colorado Chapter Code Change Committee

Revise as follows:

R202
DEFINITIONS

Accessory Structure. A structure ~~not greater than 3,000 square feet (279 m2) in floor area, and~~ not more than two stories in height, the use of which is customarily accessory to and incidental to that of dwelling (s) and which is located on the same lot.

Reason: This code change proposal will delete the limitation of an accessory structure being 3,000 square feet or less. It does not make sense to limit accessory structures to only 3,000 square feet when there is no restriction to a size of a single family dwelling. These types of structures are typically used for vehicle and farm equipment storage, shops, etc. and are still only accessory and incidental to that of a dwelling. Houses in rural areas routinely need much larger accessory structures to store farm equipment.

Cost Impact: Will not increase cost

Analysis: This term is also defined in the *International Wildland-Urban Interface Code*. The definitions were not identical and this proposal does not make them identical.

RB10-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-ACCESSORY STRUCTURE-RB-PATE

RB11 – 13
R202

Proponent: Mike Winkler, Chair of the IRC Interpretations Committee, representing IRC interpretations committee

Revise as follows:

R202
DEFINITIONS

ACCESSORY STRUCTURE. A structure <u>with a total floor area</u> not greater than 3,000 square feet (279m^2) <u>including basements</u> ~~in floor area~~, and not over two stories in height, the use of which is customarily accessory to and incidental to that of the dwelling(s) and which is located on the same *lot*.

Reason: The current language is silent on whether the 3,000 square foot limit is per floor or the total aggregate area of all floors. This oversight was the subject of a formal interpretation and the IRC interpretation committee is requesting the language be amended to reflect the committees' interpretation. The revisions only clarify the scope of the IRC relating to accessory buildings. A larger building would not be prohibited; it would simply need to comply with the IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: This term is also defined in the *International Wildland-Urban Interface Code*. The definitions were not identical and this proposal does not make them identical.

RB11-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-ACCESSORY STRUCTURE-RB-WINKLER

RB12 – 13
R202

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

SECTION R202
DEFINITIONS

ATTIC. The unfinished space between the ceiling assembly ~~of the top *story*~~ and the roof assembly.

Reason: The current definition of "attic" is insufficient in that it excludes spaces that clearly should be regulated. Attics exist at locations other than the top story. It encourages a lack of uniformity in enforcement and confusion from all users of the code.

Examples of areas where the current definition becomes problematic include rules regarding attics with limited storage, exposed foam plastics, insulation requirements, fire separations, draft stops, structural requirements, access, and ventilation. These rules are intended to apply to all attics, not just those defined as being above the top story.

Cost Impact: None

RB12-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-ATTIC-RB-DAVIDSON

RB13 – 13
R202

Proponent: David Hall CFM, Georgetown, Texas representing the ICC PMG Code Action Committee (Dave.Hall@georgetown.org)

Revise as follows:

SECTION R202
DEFINITIONS

BACKFLOW PREVENTER. A backflow prevention assembly, a backflow prevention device or other means or method to prevent backflow into the potable water supply.

Reason: The proposed language was approved for the 2015 IPC. This definition is used throughout the code. However, it does not define to the user of the code, how to specifically identify or apply proper "protection" to a use or connection. Industry standards differentiate between backflow prevention devices and backflow prevention assemblies. A backflow prevention assembly is a specific type of mechanical backflow prevention protection which is field testable and repairable in-line, with shutoff valves and test cock fittings.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes. For PMGCAC member reference, this was item no. X1 on the PMGCAC IRC-P list.

Cost Impact: The code change proposal will not increase the cost of construction.

RB13-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

202 BACKFLOW PREVENTER-RB-HALL-PMGCAC

RB14 – 13
R202

Proponent: Michael S. Moss, American Backflow Prevention Association (msmoss@utah.gov)

Revise as follows:

R202
DEFINITIONS

BACKFLOW PREVENTER. A backflow prevention assembly, a backflow prevention device or other means or methods to prevent backflow into the potable water supply.

Reason: This definition is used throughout the code. However, it does not define to the user of the code, how to specifically identify or apply proper “protection” to a use or connection. Industry standards differentiate between backflow prevention devices and backflow prevention assemblies. A backflow prevention assembly is a specific type of mechanical backflow prevention protection which is field testable and repairable in-line, with shutoff valves and test cock fittings.

Cost Impact: The code change proposal will not increase the cost of construction.

RB14-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-BACKFLOW PREVENTER-RB-MOSS.doc

RB15 – 13
R202

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials

Add definitions as follows:

SECTION R202
DEFINITIONS

BALCONY. An exterior floor projecting from and supported by a structure without additional independent supports.

DECK. An exterior floor system supported on at least two opposing sides by an adjoining structure and/or posts, piers, or other independent supports.

Reason: This proposal restores the definitions for “balcony” and “deck” that had previously been in the IRC. There is a need for a definition of the terms because of their frequent use in the IRC and in ICC Evaluation Service Reports that are not as easily understood with undefined terms. In fact, there is now an entire section in the IRC title “Decks”. The definitions were deleted from the IRC in the last code cycle because of structural interpretation issues that had nothing to do with the need for the definitions. The terms are frequently used in the IRC and there needs to be a means to distinguish between the terms “balcony” and “deck”, both of which are regulated. These definitions are necessary to create some uniformity in code interpretations and to prevent unnecessary regulations from being imposed.

Cost Impact: None

RB15-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-BALCONY (NEW)-RB-DAVIDSON

RB16 – 13
R202

Proponent: David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Revise definition as follows:

R202
DEFINITIONS

CONDITIONED SPACE. For energy purposes, space within a building that is provided with heating and/or cooling *equipment* or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with a *conditioned space*. For mechanical purposes, an area, room or space that is ~~being heated or cooled by any *equipment* or *appliance*.~~ enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate thru openings with conditioned spaces, where they are separated from conditioned spaces by un-insulated walls, floors or ceilings or where they contain un-insulated ducts, piping or other sources of heating or cooling.

Reason: This revised language was approved for the 2015 IMC. Confusion exists between the two different definitions in the IRC and IECC. The IECC attempts to define how a space is indirectly conditioned; however, further clarification is needed. This proposed change is similar to the definition in ASHRAE 90.1 – 2010.

Cost Impact: The code change proposal will not increase the cost of construction.

RB16-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R**202-CONDITIONED SPACE-RB-HALL-PMGCAC**

RB17 – 13
R202

Proponent: Michael S. Moss, American Backflow Prevention Association (msmoss@utah.gov)

Revise as follows:

R202
DEFINITIONS

BACKFLOW PREVENTER. A backflow prevention assembly, a backflow prevention device or other means or methods to prevent backflow into the potable water supply.

Reason: This definition is used throughout the code. However, it does not define to the user of the code, how to specifically identify or apply proper “protection” to a use or connection. Industry standards differentiate between backflow prevention devices and backflow prevention assemblies. A backflow prevention assembly is a specific type of mechanical backflow prevention protection which is field testable and repairable in-line, with shutoff valves and test cock fittings.

Cost Impact: The code change proposal will not increase the cost of construction.

RB17-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-BACKFLOW PREVENTER-RB-MOSS.doc

RB18 – 13
R202

Proponent: David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new definition as follows:

R202
DEFINITIONS

<u>**FACTORY MADE AIR DUCT.** A listed and labeled duct manufactured in a factory and assembled in the field in accordance with the manufacturer's installation instructions and conditions of the listing.</u>

Reason: The term is used in Sections M1601.1.1 and M1601.2 but is not defined. It is unclear if the term includes both factory-built fibrous glass ducts and flexible ducts and also any other duct material made in a factory. The IMC does not use this term which is unique to the IRC. Section M1601.2 requires that factory made ducts be listed to UL 181 and that standard does not limit the material.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB18-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-FACTORY MADE AIR DUCT (NEW)-RB-HALL-PMGCAC

RB19 – 13
R202

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, Products in Fibre-reinforced Cement and self

Revise as follows:

R202
DEFINITIONS

FIBER-CEMENT (BACKER BOARD, SIDING, SOFFIT, TRIM, AND UNDERLAYMENT) PRODUCTS. ~~A~~ M~~m~~anufactured thin section composites of hydraulic cementitious matrices and discrete non-asbestos fibers.~~, fiber-reinforced products made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with discrete organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted.~~

Reason: The current definition is limited to fiber-cement siding products. The proposal corrects the definition to that published in ASTM C1154-06, *Standard Terminology for Non-Asbestos Fiber-reinforced Cement Products* (see attached copy of ASTM C1154-06), for "fiber-cement products". Additional text describes types of fiber-cement products to include also fiber-cement backer board, soffit, trim and underlayment products currently recognized in the Code (IRC Sections R703.10, R703.10.1, R703.10.2, Table R503.2.1.1(2), and R702.4.2) The proposed code change eliminates a barrier to trade by including other fiber-cement products currently permitted by the Code.

IBC Section 202 has, as a result of the Group A IBC Code Hearings, already been revised to this definition (see attached "Final Action Hearing" results). This proposed revision would bring the two code definitions of "Fiber-cement Products" into alignment.

Cost Impact: The code change proposal will not increase the cost of construction because the change simply corrects the current definition to be consistent with the National Standard and provides examples of the types of products covered by the definition.

RB19-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-FIBER CEMENT (BACKER BOARD, SIDING, SOFFIT, TRIM AND UNDERLAYMENT) PRODUCTS-RB-MULDER

RB20 – 13
R202

Proponent: Bob Eugene, representing UL LLC (Robert.Eugene@ul.com)

Revise as follows:

R202
DEFINITIONS

FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

> **Factory-built fireplace.** A *listed* and *labeled* fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.
>
> ~~**Masonry chimney.** A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.~~
>
> **Masonry fireplace.** A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

Reason: Eliminates duplication of definition of masonry chimney which is defined with the letter "M" definitions.

Cost Impact: None

RB20-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-FIREPLACE-EUGENE

RB21 – 13
R202

Proponent: David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new definition as follows:

R202
DEFINITIONS

<u>FLEXIBLE AIR CONNECTOR. A conduit for transferring air between an air duct or plenum and an air terminal unit, an air inlet or an air outlet. Such conduit is limited in its use, length and location.</u>

Reason: The code does not define "flexible air connector." As seen in the field, flexible air connectors are often indistinguishable from flexible ducts and the only way to tell them apart is to look at their labels. It is the product listing and label that dictates whether the product is an air connector or an air duct. This definition was approved for the 2015 IMC.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC). The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB21-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-FLEXIBLE AIR CONNECTOR (NEW)-RB-HALL-PMGCAC

RB22 – 13
R202 (New)

Proponent: Michael Gardner, representing Gypsum Association (mgardner@gypsum.org)

Add new definition as follows:

R202
DEFINITIONS

GYPSUM BOARD. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board and water-resistant gypsum backing board complying with the standards listed in Section R702.3 and Part IX of this code are types of gypsum board.

Reason: The IRC has incorporated the term gypsum board since the creation of the first edition of the code; however, the code does not define the term. To correct this oversight, this proposal adds a definition for gypsum board.

The definition of gypsum board in the IBC was modified during the Group 'A' hearings in 2012. The proposed definition in this proposal is identical to the definition that will appear in the 2015 IBC. It is also the definition contained in the ASTM standards referenced in Section R702.3.

A separate proposal submitted by the Gypsum Association proposes to add language to Chapters 2 and 7 to define and incorporate gypsum panel products. Adding the panel product definition to the code creates the need to add a definition for gypsum board. Gypsum boards are paper-faced gypsum sheet materials. Gypsum panel products are gypsum sheet materials with facings other than paper.

Cost Impact: None.

RB22-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-GYPSUM BOARD (NEW)-RB-GARDNER

RB23 – 13
R202

Proponent: Joseph D. Belcher, JDB Code Services, Inc, representing the International Hurricane Protection Association (joe@jdbcodeservices.com)

Add new definition as follows:

R202
DEFINITIONS

<u>**IMPACT PROTECTIVE SYSTEM**: Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached, or locked over exterior glazing.</u>

Reason: Definition is added as companion to proposed change to Section R105.1 adding impact protective systems to the permitting requirements of the code. The definition is taken from ASCE 7-10 to assure consistency.

Cost Impact: The proposal is to add a definition and will have no cost.

Staff Analysis: Mr. Belcher has a companion change for a new Section 614 that has criteria for impact protective systems. Requirements for these types of systems are in the IRC in Section R301.2.1.2 and R612.6.

RB23-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202 IMPACT PROTECTIVE SYSTEM (NEW)-RB-BELCHER

RB24 – 13
R202

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards

Revise as follows:

R202
DEFINITIONS

MASONRY UNIT. Brick, tile, stone, <u>architectural cast stone,</u> glass block or concrete block conforming to the requirements specified in Section 2103 of the *International Building Code*.

Reason: In the last cycle a reference to ASTM C1364 for architectural cast stone was added to Section 2103 of the IBC. This modification clarifies that architectural cast stone materials cited within the IRC must also comply with the material requirements for these products as required by the IBC.

Cost Impact: This code change will not increase the cost of construction.

RB24-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-MASONRY UNIT-THOMPSON

RB25 – 13
R202 (New)

Proponent: David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new definition as follows:

R202
DEFINITIONS

<u>MECHANICAL JOINT.</u>

1. <u>A connection between pipes, fittings, or pipes and fittings that is not welded, brazed, caulked, soldered, solvent cemented or heat-fused.</u>
2. <u>A general form of gas or liquid-tight connections obtained by the joining of parts through a positive holding mechanical construction such as, but not limited to, flanged, screwed, clamped or flared connections.</u>

Reason: This language will be the 2015 IMC. Heat fusion is now a defined type of joint for plastic piping, and is considered to be separate from welding because there is no additional filler material used in forming the joint. However, heat-fusion joints are not mechanical joints and as such should be excluded from the definition of mechanical joints.

Cost Impact: This proposal will not increase the cost of construction.

RB25-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

202-MECHANICAL JOINT (NEW)-RB-HALL-PMGCAC

RB26 – 13
R202 (New)

Proponent: Mark S. Graham, representing National Roofing Contractors Association (mgraham@nrca.net)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new definitions as follows:

R202
DEFINITIONS

PHOTOVOLTAIC MODULE. A complete, environmentally-protected unit consisting of solar cells, optics and other components, exclusive of a tracker, designed to generate DC power when exposed to sunlight.

PHOTVOLTAIC PANEL. A collection of modules mechanically fastened together, wired and designed to provide a field-installable unit.

Reason: This code change proposal is intended to clarify the code by providing specific terms and definitions for photovoltaic devices already addressed in the Code.

These definitions for the terms "photovoltaic module" and photovoltaic panel" are taken from NFPA 70, "National electrical Code, 2011 Edition."

This same code change proposal was submitted for consideration as a portion of S3-12 for Group A of the International Building Code and was Approved as Modified; the modification was to a portion of the code change proposal separate from the definitions.

Cost Impact: This code change proposal will not increase the cost of construction

RB26-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-PHOTOVOLTAIC MODULE (NEW)-RB-GRAHAM

RB27 – 13
R202

Proponent: Mark S. Graham, representing National Roofing Contractors Association (mgraham@nrca.net)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new definitions as follows:

R202
DEFINITONS

PHOTOVOLTIAC ~~MODULES/~~SHINGLES. A roof covering ~~composed of flat-plate photovoltaic modules fabricated into~~ that <u>resembles</u> shingles <u>and incorporates photovoltaic modules</u>.

Reason: This code change proposal is intended to clarify the term and definition for "photovoltaic modules/shingles" in Chapter 2-Definitons and make it consist with that of the next edition of the International Building Code.

This same code change proposal was submitted for consideration as a portion of S2-12 for Group A of the International Building Code and was Approved as Modified; the modification was to a portion of the code change proposal separate from the definition.

Cost Impact: This code change proposal will not increase the cost of construction

RB27-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-PHOTOVOLTIAC MODULES/SHINGLES-RB-GRAHAM

RB28 -13
R202

Proponent: David Hall CFM, Georgetown, Texas representing the ICC PMG Code Action Committee (Dave.Hall@georgetown.org)

Revise as follows:

R202
DEFINITIONS

PLUMBING SYSTEMS. ~~Includes the water supply and distribution pipes, plumbing fixtures, supports and appurtenances; soil, waste and vent pipes; sanitary drains and *building sewers* to an *approved* point of disposal.~~ <u>Includes the water distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and building drains; in addition to their respective connections, devices and appurtenances within a structure or premises; and the water service, building sewer and building storm sewer serving such structure or premises.</u>

Reason: The proposed language was approved for the 2015 IPC. There is no technical reason for the IRC and the IPC to be different for this definition.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes. For PMGCAC member reference, this was item no. X3 on the PMGCAC IRC-P list.

Cost Impact: The code change proposal will not increase the cost of construction.

RB28-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

202 PLUMBING SYSTEMS-RB-HALL-PMGCAC

RB29 – 13
R202

Proponent: Michael S. Moss, American Backflow Prevention Association (msmoss@utah.gov)

Revise as follows:

R202
DEFINITIONS

POLLUTION. ~~An~~ A low hazard or non-health hazard impairment of the quality of the potable water to a degree that does not create a hazard to the public health, but that does adversely and unreasonably affect the aesthetic qualities of such potable water supply for domestic use.

Reason: The code does not define "low hazard" or non-health, however, the term is used in Table 608.1 as a footnote. This terminology is required to more correctly determine the type of backflow prevention assembly, backflow prevention device, means or method which is required for the protection of the water system to ensure protection of public health.

Cost Impact: This code change proposal will not increase the cost of construction.

RB29-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-POLLUTION-RB-MOSS.doc

RB30 – 13
R202 (New)

Proponent: Gary J. Ehrlich, P.E., representing National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Add new text as follows:

R202
DEFINITIONS

SHINGLE FASHION. A method of installing roof or wall coverings, water-resistive barriers, flashing, or other building components such that upper layers of material are placed overlapping lower layers of material to provide for drainage via gravity and moisture control.

Reason: The purpose of this code change is to introduce to the IRC a definition for "shingle fashion". This term is used in the IBC and IRC to describe the required method of applying moisture control layers such as roof underlayment and water-resistive barriers to the building. The intent is to direct the builder, contractor or installer to place upper layers of material lapping over lower layers of material, in the fashion of placing roof shingles, so moisture is provided with a clear path to drain down and away from the building. In field investigations of buildings with mold and moisture issues, it is frequently discovered that flashing, WRBs or underlayment have been placed in ***reverse*** shingle fashion, with the upper layer tucked behind the lower layer. This permits moisture to drain behind or below the intended protective layer or material where it can be trapped and lead to mold and decay of building components. The above definition was approved earlier this cycle (G21-12) for inclusion in the 2015 IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB30-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-SHINGLE FASHION (NEW)-RB-EHRLICH

RB31– 13
R202 (New)

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Add new definition as follows:

SECTION R202
DEFINITIONS

STAIRWAY, SPIRAL. A stairway with a plan view of closed circular form and uniform section-shaped treads radiating from a minimum-diameter circle.

Reason: The IRC does not define spiral stairway however the term is defined in the IBC and consequently R201.3 states this definition would apply to spiral stairs in the IRC. The IBC definition of spiral stairway is:

> **STAIRWAY, SPIRAL.** A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

This definition is flawed. The requirement of a supporting column is superfluous and restricts many safe designs that conform to the spiral stairway geometry but provide a supporting stringer and a guard with additional handrail instead of a column. These space saving stairs function as spiral stairways with the preferred walking path at the outside perimeter and enhance their safe use with handrails on both sides without intruding into the required width as when wrapping a support column with a handrail. This change would not restrict the continued use of a column or require an additional handrail.

This change is part of several related changes being proposed to clarify the regulations related to spiral stairways. In particular please see our change to R311.7.10.1 limiting the minimum diameter and defining the point at which curved stair requirements would apply.

Cost Impact: This code change will not increase the cost of construction.

RB31-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202=STAIWAY, SPIRAL (NEW)-RB-COOPER

RB32 – 13
R202

Proponent: Richard Grace/Fairfax County/Virginia Plumbing and Mechanical Inspectors Association and Virginia Building and Code Officials Association (Richard.Grace@fairfaxcounty.gov)

Add new definition as follows:

R202
DEFINITIONS

<u>**WASTE RECEPTOR.** A floor sink, standpipe, hub drain or a floor drain that receives the discharge of one or more indirect waste pipes.</u>

Reason: A definition for "waste receptor" is needed. The term is found several times in the code with no exact description. Also, see coordinated proposed change in Chapter 27 based on this definition.

Cost Impact: This code change will not increase the cost of construction.

RB32-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R202-WASTE RECEPTOR (NEW)-RB-GRACE.DOC

RB33 – 13
R202

Proponent: David Hall CFM, Georgetown, Texas representing the ICC PMG Code Action Committee (Dave.Hall@georgetown.org)

Add new definition as follows:

R202
DEFINITIONS

<u>**WASTE RECEPTOR.** A floor sink, standpipe, hub drain or a floor drain that receives the discharge of one or more indirect waste pipes.</u>

Reason: The proposed language was approved for the 2015 IPC. A definition for "waste receptor" is needed. The term is found in the code over 10 times with no exact description.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes. For PMGCAC member reference, this was item no. X4 on the PMGCAC IRC-P list.

Cost Impact: The code change proposal will not increase the cost of construction.

RB33-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

202 WASTE RECEPTOR (NEW)-RB-HALL-PMGCAC

RB34 – 13
R301.1

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, National Council of Structural Engineers Associations; Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

R301.1 Application. Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets all requirements for the transfer of all loads from their point of origin through the load-resisting elements to the foundation. ~~Buildings and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.~~

Reason: Execution of prescriptive measures promulgated by the IRC may not result in a complete load path for the transfer of all loads from their point of origin through the load-resisting elements to the foundation.

Several examples include:

1. Absence of provision for connection between roof framing member perpendicular to interior braced wall lines.
2. Absence of prescriptive requirements to provide positive lateral force connection between roof trusses and top of wall.
3. Discontinuous load path from roof sheathing to top of wall where gap between roof sheathing and blocking is required per following figure R602.10.8.2(1).
4. Provision for anchorage requirement of 24” return panel for wall bracing located on second story.

Deleting the last sentence of R301.1 will better ensure complete load path is provided when using IRC.

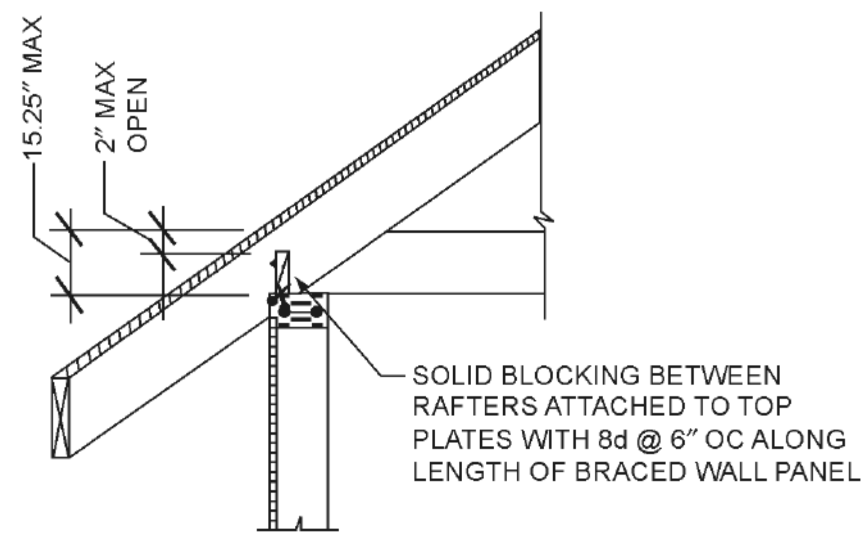


FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS

Cost Impact: This code change proposal will not increase construction cost.

RB34-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.1-RB-MLAKAR-MOORE

RB35 – 13
R301.1.1, R301.2.1.1, Table R602.3(1), Table R602.3(2), R803.2.3, R803.2.3.1 (New)

Proponent: T. Eric Stafford, Insurance Institute for Business and Home Safety

Revise as follows:

R301.1.1 Alternative provisions. As an alternative to the requirements in Section R301.1 the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards, the design shall comply with the *International Building Code*.

1. AF&PA *Wood Frame Construction Manual* (WFCM).
2. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).
3. ICC *Standard on the Design and Construction of Log Structures* (ICC 400).

   Exception: Wood structural panels used as roof sheathing for wood roof framing shall be attached in accordance with Section R803.

R301.2.1.1 Wind limitations and wind design required. The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2(4)B or where the basic wind speed from Figure R301.2(4)A equals or exceeds 110 miles per hour (49 m/s).

Exceptions:

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R611.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R613.
3. Wood structural panels used as roof sheathing for wood roof framing shall be attached in accordance with Section R803.

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER[b,c,e]	SPACING OF FASTENERS	
			Edges (inches)[i]	Intermediate supports [c,e]
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing				
32	3/8" - 1/2"	6d common (2" x 0.113") nail (subfloor wall)[j] 8d common (2½" x 0.131") (roof)[f,k]	(*no change to remainder of table)*	
33	19/32" - 1"	8d common (2½" x 0.131") nail (subfloor wall) (roof)[f,k]		

f. For regions having basic wind speed of 110 mph or greater, ~~8d deformed (21/2" × 0.120)~~ ring-shank nails complying with Section R803.2.3.1 shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.

k. Where wind design is required in accordance with Figure R301.2(4)B, wood structural panel roof sheathing shall be fastened in accordance with Section R803.2.3.1.

(Portions of table and footnotes not shown to remain unchanged.)

TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION[a.b] OF FASTENER AND LENGTH (inches)	SPACING[c] OF FASTENERS	
		Edges (inches)[i]	Intermediate supports [c,e]
Wood structural panels, subfloor, roof[g,h] and interior wall sheathing to framing and particleboard wall sheathing to framing[f]			

h. Where wind design is required in accordance with Figure R301.2(4)B, wood structural panel roof sheathing shall be fastened in accordance with Section R803.2.3.1.

(Portions of table and footnotes not shown to remain unchanged.)

R803.2.3 Installation. Wood structural panel used as roof sheathing shall be installed with joints staggered or not staggered in accordance with Table R602.3(1), or APA E30 for wood roof framing or with Table R804.3 for steel roof framing. Where wind design is required in accordance with Figure R301.2(4)B, wood structural panels used as roof sheathing for wood framed roofs shall be installed with joints staggered and fastened in accordance with Section R803.2.3.1.

R803.2.3.1 Sheathing fastenings. Wood structural panel sheathing shall be fastened to roof framing with ring-shank nails spaced not more than 6 inches on center at edges and 6 inches on center at intermediate framing. Ring-shank nails shall have the following properties:

1. Not less than 0.113-inch nominal shank diameter
2. Ring diameter shall be 0.005-inch larger than nominal shank diameter
3. Rings shall be not less than ¾-inch from the head
4. 16 to 32 rings per inch
5. 0.270 inch nominal full round head diameter; for other head shapes such as D and clipped heads, the smaller dimension shall be not less than 0.190-inches and the larger dimension shall be not less than 0.270-inches
6. Not less than 2 3/8-inch nominal nail length

Exceptions:

1. Where roof framing with a specific gravity of 0.42 to not more than 0.49 is used, ring-shank nails shall be spaced not more than 4-inches on center in Nailing Zone 3 in accordance with Figure R803.2.3.1 where the basic wind speed equals or exceeds 130 mph.
2. Where roof framing with a specific gravity of 0.42 to not more than 0.49 is used, ring-shank nails shall be spaced not more than 12 inches on center at intermediate framing in the following Nailing Zones:
   - 2.1. In nailing zone 1 in accordance with Figure R803.2.3.1 for any basic wind speed, and
   - 2.2. In nailing zone 2 in accordance with Figure R803.2.3.1 where the basic wind speed is not more than 110 mph.
3. Where roof framing with a specific gravity of 0.49 or more is used, ring-shank nails shall be spaced not more than 12 inches on center at intermediate framing in the following Nailing Zones:
   - 3.1 In nailing zone 1 in accordance with Figure R803.2.3.1 for any basic wind speed, and
   - 3.2 In nailing zone 2 in accordance with Figure R803.2.3.1 where the basic wind speed is not more than 120 mph.
4. Where roof framing with a specific gravity of 0.49 or more is used, 8d common or 8d hot dipped galvanized box nails shall be spaced not more than 6 inches on center at edges and 6 inches on center at intermediate framing where the basic wind speed is not more than 100 mph.

5. <u>Where the roof diaphragm shear load exceeds 170 plf in the direction parallel to the ridge or 225 plf in the direction perpendicular to the ridge, the size and spacing of fasteners shall be designed to resist the applicable shear load.</u>

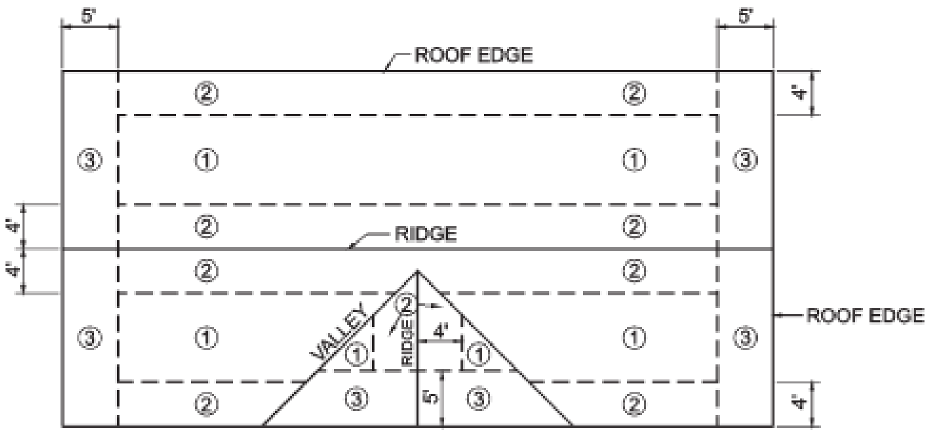


FIGURE R803.2.3.1
WOOD STRUCTURAL PANEL ROOF SHEATHING NAILING ZONES

Reason: Table R602.3(1) in the IRC currently requires the use of deformed shank nails in higher wind regions and on locations of the roof where pressures are known to be the highest. Thus, the IRC currently recognizes the benefit of using deformed shank fasteners for attaching roof sheathing to resist wind loads. However, the IRC is somewhat inconsistent with the specification of the deformed shank fasteners required in Table R602.3(1). This proposal corrects that inconsistency and specifically references the nail dimensions that are consistent with tests that form the basis for this proposal.

This proposed modification, if approved, will significantly improve the performance of wood structural panel roofs when subjected to high wind loads. It does so at a minimal to negligible cost which provides an extremely generous benefit/cost ratio. The requirements are based on hundreds of true wood structural panel tests. Extensive roof sheathing fastening tests at Clemson University (Reinhold 2000 – 2002, McKinley 2001) and at the International Hurricane Center – Florida International University (Reinhold, Alvarez 2003) compared the Mean Failure Pressure in psf for roof sheathing panels using both the 8d common and the 8d ring shank nails spaced at 6 inches as prescribed by the code. Sheathing consisted of 5/8 inch thick plywood attached to nominal 2x4 Southern Yellow Pine rafters.

The results of these tests were as follows:

1. Mean ultimate uplift capacity for panels attached with 8d common nails at 6 inch spacing: 126 pounds per square foot
2. Mean ultimate uplift capacity for panels attached with 8d ring shank nails at 6 inch spacing: 292 pounds per square foot

This shows a 131% improvement in performance when 8d ring shank nails are used instead of the currently prescribed 8d common nails. The original nail specifications adopted in the Florida Building Code and submitted to the IBC have been modified based on additional tests of nail withdrawal capacities. This testing has shown that a wider variety of ring dimensions consistently produce enhanced withdrawal capacities over those of smooth hank nails. The new specifications are more inclusive of nails available from a number of manufacturers and recognize that nail head characteristics can be varied without reducing the reliability of the sheathing attachment because of the close spacing of fasteners required for higher design load situations.

Additionally, the tests showed that the mean ultimate nail pullout for the 8d common nail was 175 lbs which is about half the value given by the NDS.

Requiring the use of 8d ring shank nails would result in an almost negligible increase in cost. While variations will occur regionally, it's estimated that the cost increase will be less than $10 for 2000 square foot roof.

This proposal is written with wind speed triggers that are consistent with the current wind speed maps in the IRC. However, the author is aware of a group developing a code change proposal to update the wind speed maps in the IRC, including applicable wind speed triggers, to be consistent with the IBC and ASCE 7-10. Therefore, a corresponding code change has been submitted that provides wind speed triggers consistent with the wind speed maps in the IBC and ASCE 7-10. If the proposal to adopt the wind speed maps from the IBC and ASCE 7-10 is approved for the IRC, it is recommended that the corresponding proposal be approved.

Cost Impact: will increase cost

RB35-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.1.1-RB-STAFFORD

RB36 – 13

R301.1.3.1 (New)

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, National Council of Structural Engineers Associations; Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Add new text as follows:

R301.1.3.1 Wood-frame structures. The building official shall require construction documents to be approved and stamped by a licensed architect or engineer for all dwellings of wood-frame construction more than one story in height above grade plane that are located in Seismic Design Category D_0, D_1, D_2 or E.

Reason: After the 1994 Northridge earthquake, Los Angeles City building officials and the Structural Engineers Association of Southern California Wood Frame Construction Joint Task Force recommended that the quality of wood frame construction be greatly improved for regions of significant seismic risk. For buildings or structures located in Seismic Design Category D and E, the requirement to have a California licensed architect or engineer prepare construction documents is intended to minimize or reduce structural deficiencies that may cause excessive damage or injuries in wood frame buildings. Licensed architects and engineers can reduce or eliminate the design of structural deficiencies such as plan and vertical irregularities, inadequate construction details necessary to transfer seismic shear transfer throughout the seismic force-resisting system and improper application of prescriptive requirements of the California Residential Code. This is consistent with the intent of efforts following the costly 1994 Northridge earthquake.

This proposal recommends that the use of IRC be limited to **single story buildings in SDC D and E.** This is consistent with the conventional provisions in the **2012 IBC (Section 2308.12.1).**

Reference:

B. Schmidt, R. Harder, circa 1994, “Report on Plywood Shear Wall Performance,” City of Los Angeles Department of Building and Safety and Structural Engineers Associations of Southern California Joint Task Force Plywood Shear Wall Committee

Cost Impact: This code change proposal may increase construction cost but should reduce damage after an earthquake event.

RB36-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

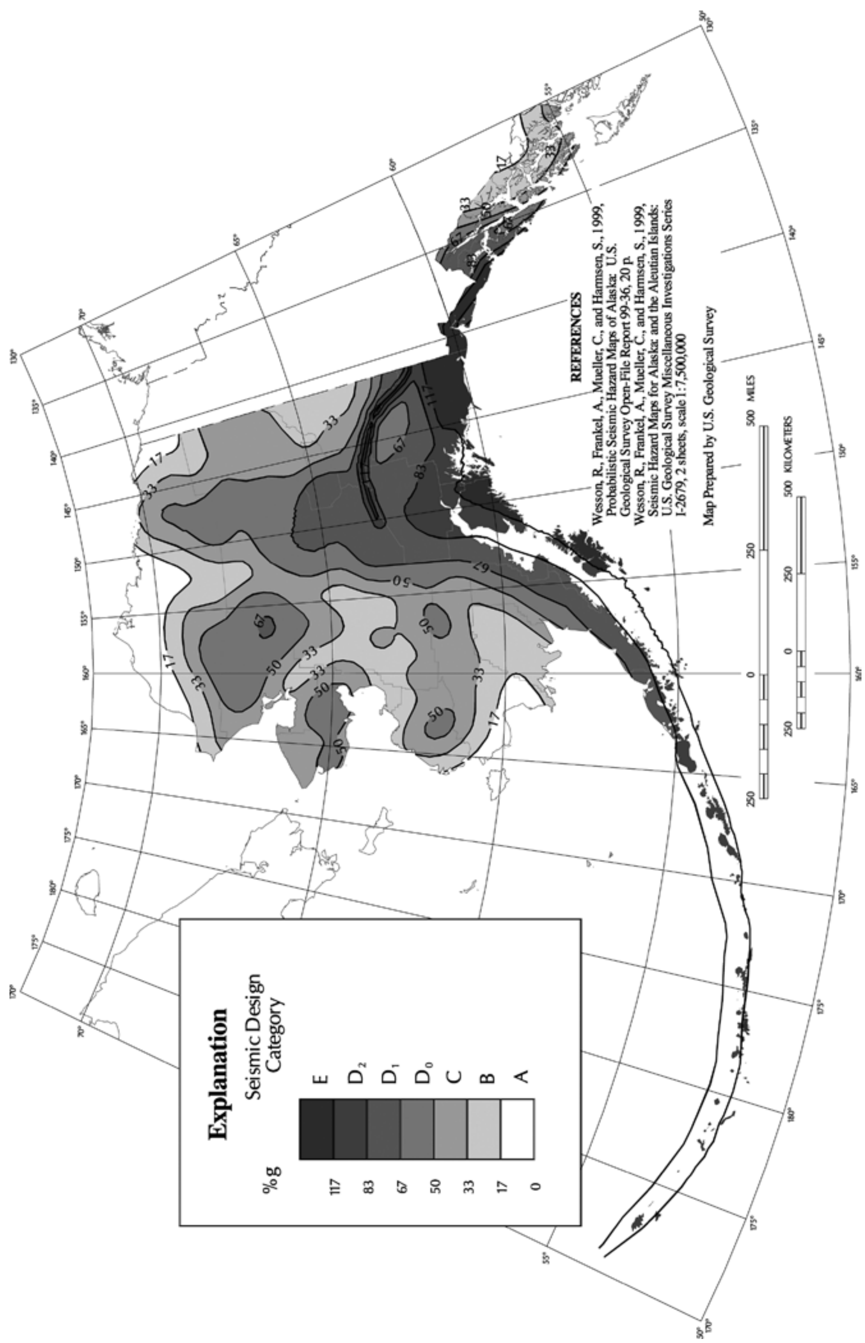
R301.1.3.1 (NEW)-RB-MLAKAR-MOORE

RB37 – 13
Figure R301.2(2)

Proponent: James Bela, Oregon Earthquake Awareness, representing Oregon Earthquake Awareness

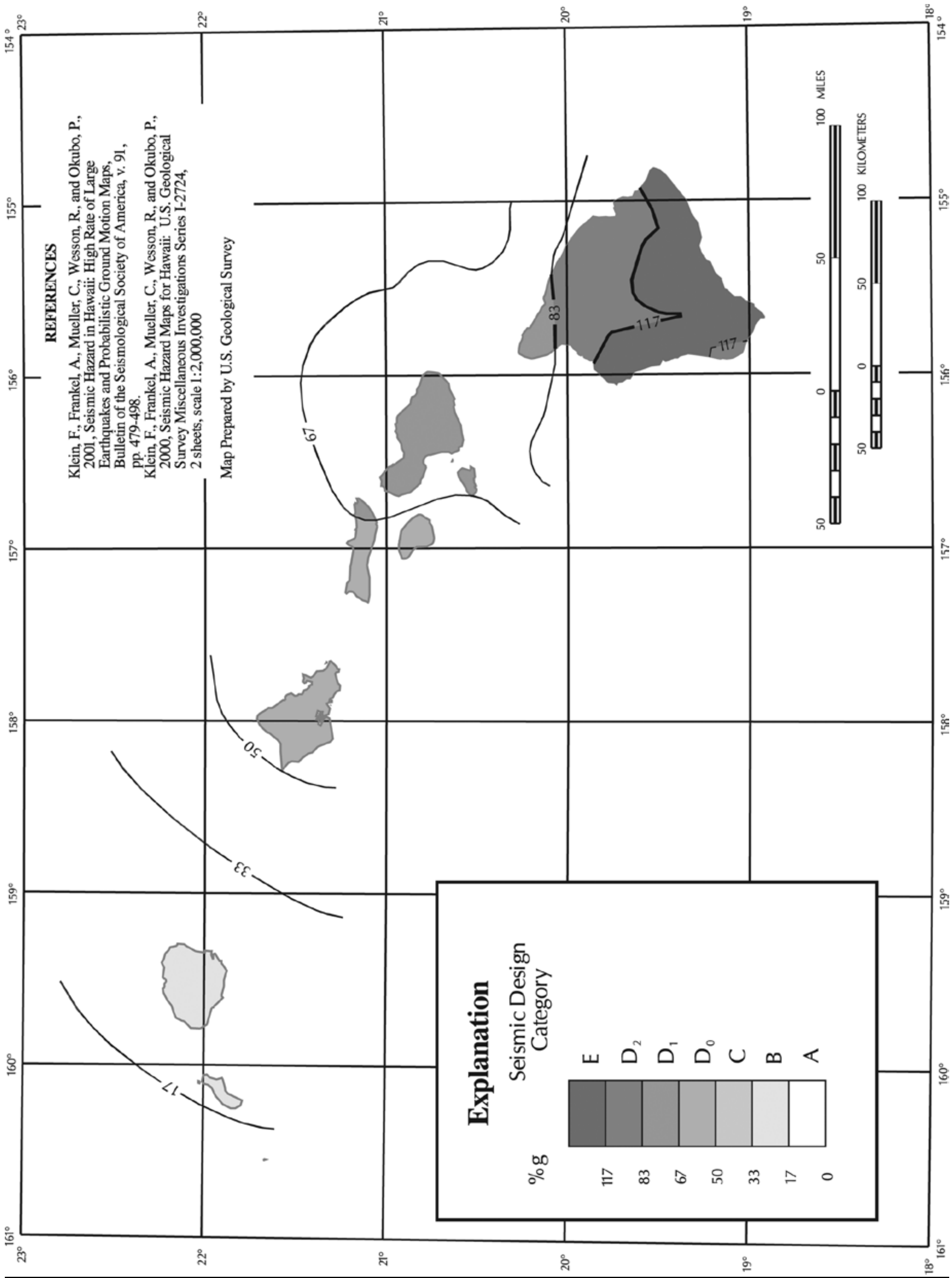
Delete and substitute as follows:

~~**FIGURE R301.2(2)**~~
~~**SEISMIC DESIGN CATEGORIES—**~~
~~**SITE CLASS D**~~



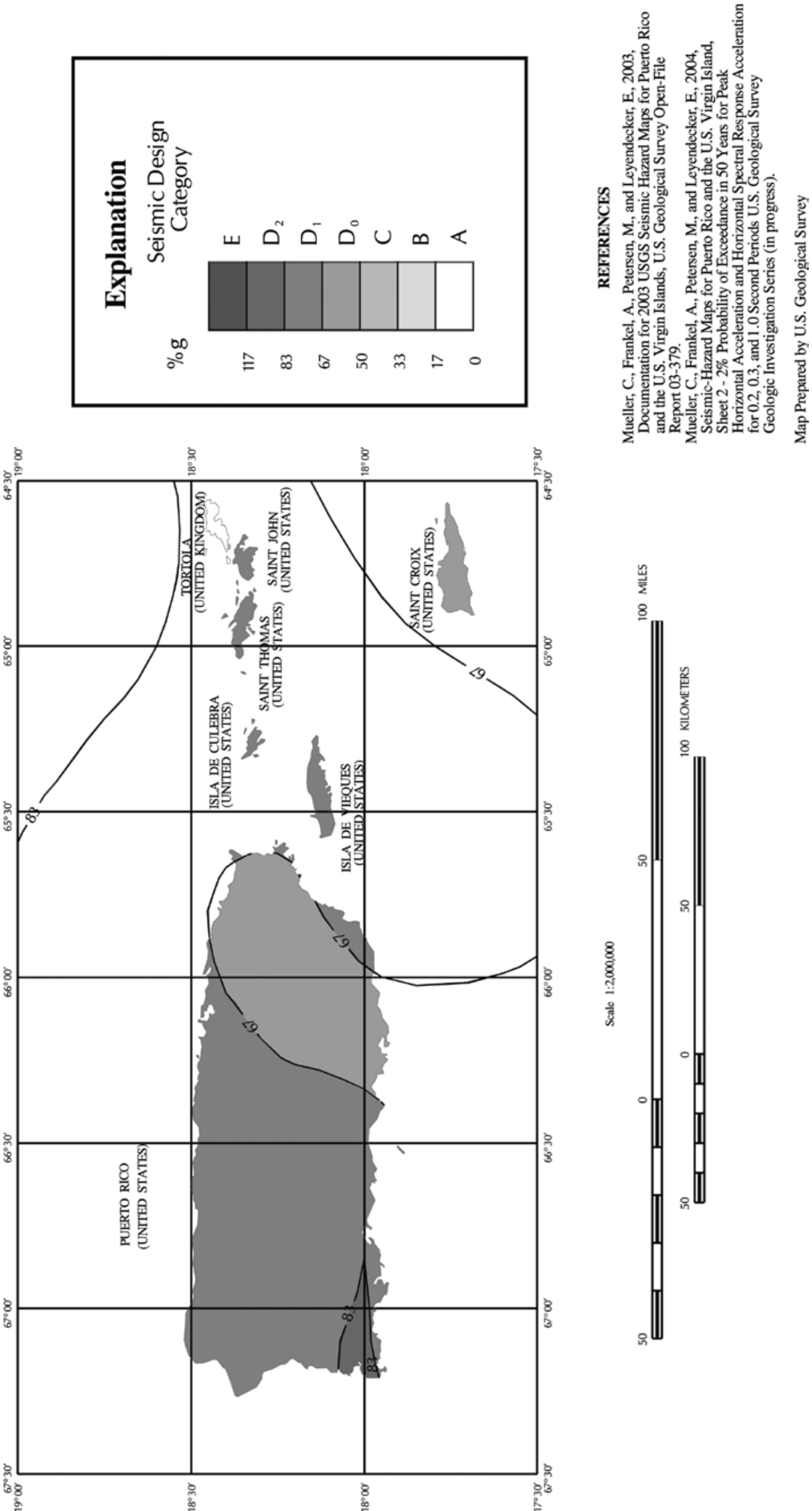
For SI: 1 mile = 1.61 km.

FIGURE R301.2(2)
SEISMIC DESIGN CATEGORIES—SITE CLASS D
(continued)



For SI: 1 mile = 1.61 km.

FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D
(continued)



For SI: 1 mile = 1.61 km.

FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D
(continued)

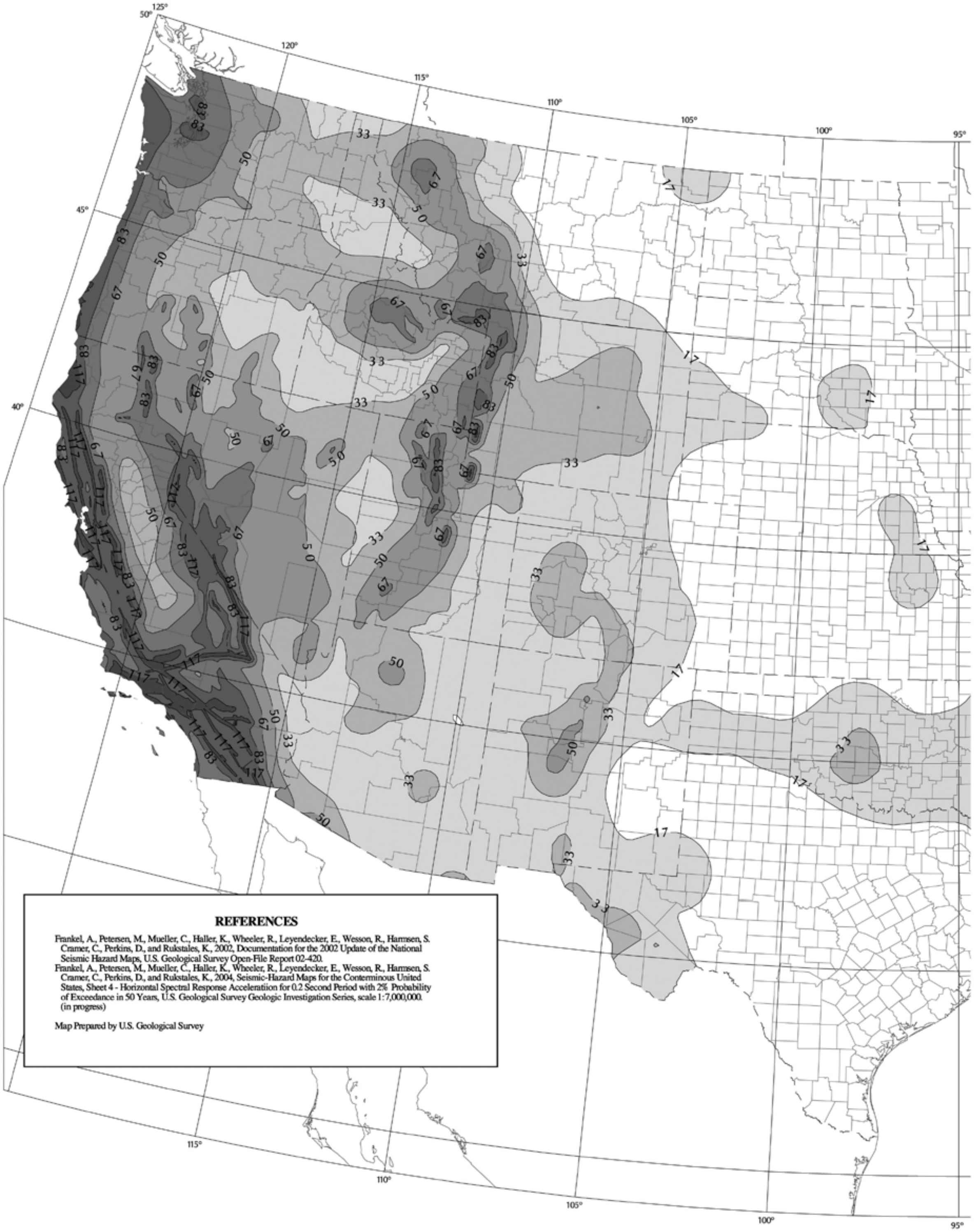


FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D
(continued)

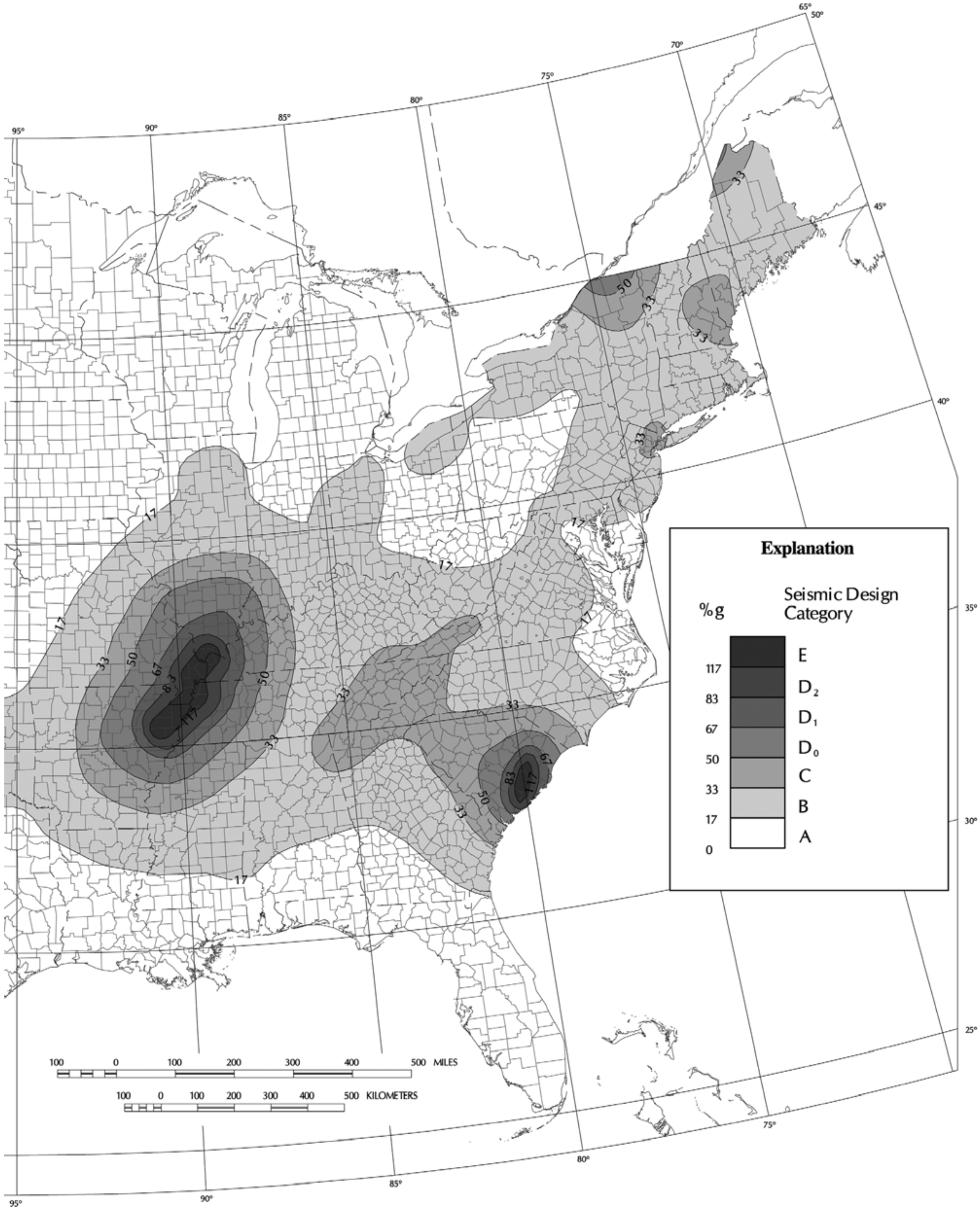


FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D
(continued)

Reason: This proposal replaces the Risk-Targeted seismic design maps of the 2012 IRC with the same named figures from the previous 2009 edition, thereby deleting Risk-Targeted seismic design maps from the code.

So-called Risk-Targeted National Seismic Hazard Maps are not appropriate for protecting public safety in residential construction, because they do not realistically consider the "maximum potential earthquake" impacts and effects from known "active" earthquake source regions; in particular from the M 9 Cascadia subduction zone along coastal regions of the entire Pacific Northwest.

The NOW so-called Risk Basis is: (a) arbitrary; (b) not explicitly defined; (c) unsubstantiated by any true standards approval process; (d) not a true consensus; and (e) inappropriate for such huge inventories of residential structures (where minimal efforts in design implementation and expense for resiliency in realistic earthquake threats both can and should make major differences in the intended outcomes). Since earthquakes are by their very natures "rare events," any perceived or assigned probabilities as to their likelihood, occurrence, reoccurrence, periodicity, frequency, return period, etc. are most assuredly "unreliable."

Specifically, these newly derived maps are not meeting the R101.3 Intent or purpose of this code: which is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, **structural strength**, means of egress facilities, **stability**, **sanitation,** light and ventilation, energy conservation and **safety to life and property** from fire and other **[earthquake] hazards** attributed to the built environment and **to provide safety to fire fighters and emergency responders during emergency operations.**

(1) Constantly changing the USGS National Seismic Hazard Maps' "ground motion response accelerations contours" is **destabilizing** to design practice, plan review requirements, and code enforcement provisions, because such changes are:
- **(a)** creating **yo-yo earthquake design standards** – "high" one code cycle and "low" the next; or vice-versa; making it, as a result, ever more difficult to develop, practice and apply "professional engineering judgment" in the design process.
- **(b)** creating serious and perplexing problems for addressing seismic hazards for **existing buildings** – which must then **"benchmark"** to a specific year and to a specific version (year & edition) of seismic hazard map (for any specific public policy mandate/requirements for earthquake retrofit/mitigation ordinances or measures. These required "benchmark" seismic hazard maps will then be different (sometimes a lot different) from the current (and ever-changing and ever-evolving) USGS National Seismic Hazard Maps. This is, and will continue to be, a big source of confusion.

(2) **RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS** contours in the IBC 2012 / ASCE 7-10 are sometimes **30% lower** than previous map values of just a decade ago:
- **(a)** the recent 08-23-2011 M 5.8 Mineral VA (Cuckoo) earthquake had 30% lower design values (with these new maps) than a decade ago – making the earthquake's epicentral region **Seismic Design Category A-B**; yet the **actual intensity of earthquake ground shaking** experienced there was the "stated intensity" that could be expected for the IBC/ASCE 7-10 designation **SDC D!**.(Bela 2011)
- **(b)** when the seismic hazard maps **depict such low hazard ground motion response accelerations** and their corresponding **low** Seismic Design Categories, they both foster and create the "circumstances" for **"comfortable inaction;"** and, unfortunately, this feeling of "comfortable inaction" easily transfers to the arena of public policy.
- **(c)** The condition of "comfortable inaction" (due to perceived low hazard - depicted on the seismic hazard map) was cited as perhaps the main culprit in Christchurch, New Zealand's lack of adequate preparedness during its recent hammering by a "pair" of earthquakes – which killed around 200 people in unsafe **"Killer Buildings"** in the M 6.3 Feb. 22, 2011 event.

(3) The basic underlying methodology for preparing the USGS National Seismic Hazard Maps (and their derivative so-called Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations contours); i.e., probabilistic seismic hazard assessment (or psha) is fatally **"flawed"** – due to systemic "errors" in the applied mathematics which both create and define it. And it is, unfortunately, these same flawed "mathematics" that are prescribing how these psha-determined ground motion contours are ultimately derived, computed . . . and then finally codified.

(4) Errors in its methodology aside, the basic problems, difficulties and really insurmountable obstacles to performing a psha seismic hazard assessment *(Mualchin, 2010; Bela and Mualchin 2011)* have **never** actually been "solved." And they still remain unsolved! These problems involve data-driven earth-science requirements for a knowledge and understanding of:
- **(a)** **fault slip rates;**
- **(b)** **frequency** of occurrence of earthquakes (and their known magnitudes); and
- **(c)** **earthquake source mechanisms** – specifically, (i) the style of faulting: and (ii) the hypocentral depth (or where exactly the earthquake rupture process begins).

(5) The psha methodology is easily "manipulated," particularly in the sense that: (i) selecting the probabilistic hazard level is a totally **arbitrary** process; and (ii) changing the hazard level (higher hazard or lower hazard) gives a completely different ground motion response acceleration contour – and consequently, then, different code requirements!

(6) These very real and insurmountable problems with psha's methodology have been swept away by its proponents: by convoluted (and mostly unintelligible) efforts and preoccupations with "logic trees," "quantifying uncertainties," etc. These efforts proceed busily ahead; but, meanwhile, they are "neglecting baseline principles" (of "what" the earthquake can do to you – and "how" it can do it – and the maximum Magnitude it could be). All that mathematical busywork, logic-tree accounting, and so-called "expert opinion" built the "better model" (or -- so the proponents believe). Unfortunately, that "better model" then:
- **(a)** has become **"substituted"** for "reality" by its creators;
- **(b)** has dismissed criticisms of it -- by claiming (itself) to be "best available science;" and
- **(c)** has become ultimately so **"complicated" --** that not even its proponents now can logically and successfully explain how it came to be (Hamburger et. al., 2010; Bela, 2011); nor can they effectively explain how to apply it to the real world of earthquake engineering, public safety, and socioeconomic issues of community resiliency.

(7) The ground motion accelerations, and their probabilities for exceeding them, are combined and co-mingled in such a way that the actual sources (or **earthquake magnitudes**, **frequency content of earthquake ground motions**, and **duration** of strong ground shaking) are treated more-or-less equally—and they are most certainly not!

(8) The **"Maximum Credible Earthquake" (MCE)** or "Maximum Capable Earthquake" or "Maximum Possible Earthquake" (within ¼ unit of Magnitude, M) is never explicitly stated. And it's really "Magnitude, Magnitude,

Magnitude!" (and for the same reasons previously stated in (4)) – that has everything to do with building performance (damage and repair costs) and, more importantly, public safety and community resilience.

(9) **R-Factors, or Response Modification Factors,** that are used in design provisions in the IBC become **less reliable** in ascertaining/predicting the **"end result"** (or the building's actual performance in an earthquake). And, **"an earthquake"** really needs to explicitly consider the full suite of earthquake possibilities that the regional tectonics forewarn us can occur (including MCE = Maximum Credible Earthquake, or Maximum Possible Earthquake). "R-Factors" have become less reliable primarily because:

(a) quite a lot of the "ductility" or building "toughness" that the code relies upon to: (i) ride out the earthquake (by bending, not breaking, and absorbing energy); and (ii) remain standing (without killing the occupants) -- is due to "over-strength;" and. **(b)** when the code design "strength" is systematically diminished (weakened) or reduced (over several-to-many iterations of seismic hazard mapping --by lowering (yo-yo effect) the "numerator" quantity in the design strength equation; then when dividing this numerator (now smaller number) by the same "large" number (R-Factor in denominator) – we have now "lost" perhaps a good portion of our "over-strength" – that was implicit in selecting the weights of the various R-Factors in the first place! Basically, with RISK-TARGETED (MCE_R) , the code is now dividing an ever-decreasing and now smaller number (perhaps by 30%) by the same "large" number (R-Factor denominator) -- with the result that the buildings' performances and outcomes are really now much less certain . . . and also now much more problematical.

(10) The psha methodology has been shown in dramatic and tragic fashion to be not only "misleading", but also deadly, in the last decade or so of the **"Eleven of the World's Deadliest Earthquakes." (Panza et. al. 2011, Table 1)** In example after example, and all across the globe (where now more than 700, 000 people have perished); the psha-methodology "prescribed" seismic hazard: was determined to be either low or very low – but was "disproved" in these many cases by earthquakes that were "surprises" from what psha had determined could be expected. In too many of these deadly "surprises", the actual intensities of ground shaking experienced were greater by factors of 2X to 4X – than what psha had predicted. (Bela 2010; Bela and Mualchin, 2011; Kossobokov and Nekrasova, 2010;) It is clear that this is an unsafe situation (to general public) that must **not** continue; but it does continue for some of these following main reasons:

(a) the psha methodology is "anonymous," so when there is clear evidence (> 700,000 casualties) that it is "not working;" no one is accountable for its: (i) external failures (mass casualties); and/or (ii) internal failures (very real errors in its "applied mathematics" derivations).

(b) the psha methodology has a hierarchial and powerful elite behind its influence and continued use.

(c) the psha methodology has a pedigree of high sounding terms (like "quantifying uncertainty," "logic-tree", "expert opinion," "best science," etc.) -- all purporting to increase the method's **"precision."** But the end result, as these Eleven Deadliest Earthquakes" have shown us, is, unfortunately, still too **"inaccurate"** and "too deadly" for protecting the public safety. And in this regard, it is clearly missing its target!

BIBLIOGRAPHY

-Bela, J. (2011). Take Me Home . . . Seismic Loads: commentary on the results of lowering the USGS National Seismic Hazard Maps (response accelerations) values by 30%; prior to the 23 August 2011 Mineral (Cuckoo) VA M 5.8 earthquake, 2 p.
-Bela, J. (2010). Table A – Fatal Evidence Global Earthquake Occurrence: since the GSHAP terminated, seismic reality was testing the prediction given by Global Seismic Hazard Maps, 3 p.-
-Bela, J. and L. Mualchin (2011). Keys to Public Safety & Disaster Reduction in view of Earthquakes and Hurricanes, EERI Annual Meeting Poster Session, San Diego, CA, 2 p.
-Kossobokov, V.G. and A.K. Nekrasova (2010). Global Seismic Hazard Program Maps are Misleading, Abstract U 13A – 0020 Poster presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.
http://www.agu.org/meetings/fm10/fm10-sessions/fm10_U13A.html
-Mualchin, L. (2010) History of Modern Earthquake Hazard Mapping and Assessment in California Using a Deterministic or Scenario Approach, Pure and Applied Geophysics Volume 168, Numbers 3-4, 383-407, DOI: 10.1007/s00024-010-0121-1
[From the issue entitled "Special Issue: Advanced Seismic Hazard Assessment. Part II: Regional Seismic Hazard and Seismic Microzonation Case Studies"]
http://www.springerlink.com/content/p301955r53nk5xl2/
-Panza, G.F.; Irikura, K.; Kouteva-Guentcheva, M.; Peresan, A.; Wang, Z.; Saragoni, R. (Eds.) (2011). Advanced Seismic Hazard Assessment, 320 p.
http://www.springer.com/earth+sciences+and+geography/book/978-3-0348-0091-4
Table 1 List of the top eleven deadliest earthquakes occurred during the period 2000-2011 and the corresponding intensity differences (ΔI) among the observed values and those predicted by the Global Seismic Hazard Assessment Program, or GSHAP.
-Allesandro Martelli, Paolo Clemente, Massimo Forni, Giuliano F. Panza, Antonello Salvatori (2011).
RECENT DEVELOPMENT AND APPLICATION OF SEISMIC ISOLATION AND ENERGYDISSIPATION SYSTEMS, IN PARTICULAR IN ITALY, CONDITIONS FOR THEIR CORRECT USE AND RECOMMENTATIONS FOR CODE IMPROVEMENTS
-12TH WORLD CONFERENCE ON SEISMIC ISOLATION, ENERGY DISSIPATION AND ACTIVE CONTROL OF STRUCTURES Sept. 20-23, 2011 Sochi-city, Russia
http://12wcsi.com/site/invitation-jacob-eisenberg

Cost Impact: The code change proposal will not increase the cost of construction (in most cases).

RB37-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2(2)F-RB-BELA

RB38 – 13
Table R301.2(1)

Proponent: Matthew L. Mlakar, Barrish Pelham & Associates, Inc., representing Structural Engineers Association of California

Revise as follows:

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND DESIGN				SEISMIC DESIGN CATEGORY[f]
	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Wind-borne debris zone[m]	

(Portions of table not shown to remain unchanged.)

a through k *(No changes to text)*

l. In accordance with Table R301.2(4)B, where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

m. In accordance with Table R301.2(4)C, the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

Reason: Currently, the special wind regions in Table R301.2(4)B and the wind-borne debris regions in Table R301.2(4)C are shown on a single map for the entire continental United States. Attempting to interpret the map in areas where the contour lines occur can be difficult and may lead to mis-application of the tables especially since the contour lines do not follow county lines or readily identifiable borders. The identification of the transitions should be provided by the local *jurisdiction* to ensure that the proper coefficients are used.

Cost Impact: The proposed change will not impact the cost of construction.

RB38-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2(1)T-RB-MLAKAR

RB39 – 13

R202, R301.2.1, R301.2.1.1, R301.2.1.2, R301.2.1.2.1 (New), R301.2.1.3, R301.2.1.4, Table R301.2(2), Table R301.2(4)A, Table R301.2(4)B, Table R301.2(4)C, Table R301.2.1.2, Table R301.2.1.3, Table R301.2.1.5.1, Table R301.2(2), Table 301.7, Figure R301.2(4)A (New), Figure R301.2(4)B, Figure R301.2(4)C, Figure R301.2(7)

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB);

Revise definitions as follows:

SECTION R202
DEFINITIONS

HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes, defined as the U.S. Atlantic Ocean and Gulf of Mexico coasts where the, ultimate design wind speed, V_{ult}~~,~~ ~~basic wind speed~~ is greater than 115 ~~90~~ miles per hour (51~~40~~ m/s), and Hawaii, Puerto Rico, Guam, Virgin Islands, and America Samoa.

WIND-BORNE DEBRIS REGION. Areas within *hurricane-prone regions* located ~~as designated in accordance with Figure R302.1(4)C.~~ :

1. Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed, V_{ult} is 130 mph (58 m/s) or greater; or
2. In areas where the ultimate design wind speed, V_{ult} is 140 mph (63.6 m/s) or greater; or Hawaii.

Revise as follows:

R301.2.1 Wind design criteria. Buildings and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design ~~basic~~ wind speed in Table R301.2(1) as determined from Figure R301.2(4)A. The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1. Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11.1 from the roof assembly to the foundation.

R301.2.1.1 Wind limitations and wind design required. The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2(4)B ~~or where the basic wind speed from Figure R301.2(4)A equals or exceeds 110 miles per hour (49 m/s)~~.

Exceptions:

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R611.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R613.

In regions where wind design is required in accordance with Figure R301.2(4)B ~~or where the basic wind speed shown on Figure R301.2(4)A equals or exceeds 110 miles per hour (49 m/s)~~, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AF&PA *Wood Frame Construction Manual* (WFCM); or

2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600); or
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7); or
4. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings* (AISI S230); or
5. *International Building Code*.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code. When ASCE 7 or the *International Building Code* is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the *International Building Code* shall be used.

~~TABLE R301.2(2)~~
~~COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)~~

~~FIGURE R301.2(4)A~~
~~BASIC WIND SPEEDS~~

~~FIGURE R301.2(4)B~~
~~REGIONS WHERE WIND DESIGN IS REQUIRED~~

~~FIGURE R301.2(4)C~~
~~WIND-BORNE DEBRIS REGIONS~~

R301.2.1.2 Protection of openings. Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 as modified in Section R301.2.1.2.1 ~~referenced therein~~. ~~The applicable wind zones for establishing missile types in ASTM E 1996 are shown on Figure R301.2(4)C.~~ Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

> **Exception:** Wood structural panels with a minimum thickness of 7/16 inch (11 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2(2) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 45 ~~33~~ feet (10 058 mm) or less where the ultimate design wind speed, V_{ult} is 180 mph or less. ~~located in Wind Zones 1 and 2 in accordance with Figure R301.2(4)C~~.

TABLE R301.2.1.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a,b,c,d]

a. This table is based on ~~130~~ 180 mph ultimate design wind speeds, V_{ult} and a 45 ~~33~~-foot mean roof height.

(Table and footnotes not shown to remain unchanged.)

R301.2.1.2.1. Application of ASTM E 1996. The text of Section 2.2 of ASTM E 1996 shall be substituted as follows:

> 2.2 *ASCE Standard:*
> ASCE 7-10 American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures

The text of Section 6.2.2 of ASTM E 1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the strength design wind speed, V_{ult}, as follows:

6.2.2.1 *Wind Zone 1*—130 mph ≤ ultimate design wind speed, V_{ult} < 140 mph.

6.2.2.2 *Wind Zone 2*—140 mph ≤ ultimate design wind speed, V_{ult} < 150 mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (58 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 160 mph (63 m/s), or 140 mph (54 m/s) ≤ ultimate design wind speed, V_{ult} ≤ 160 mph (63 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*— ultimate design wind speed, V_{ult} >160 mph (63 m/s).

R301.2.1.3 Wind speed conversion. When referenced documents are based on nominal design ~~fastest mile~~ wind speeds, the ultimate design ~~three-second gust basic~~ wind speeds, V_{ult} ~~V_{3s}~~, of Figure R301.2(4)A shall be converted to nominal design ~~fastest mile~~ wind speeds, V_{asd} ~~V_{fm}~~, using Table R301.2.1.3.

~~**TABLE R301.2.1.3**~~
~~**EQUIVALENT BASIC WIND SPEEDS**~~

TABLE R301.2.1.3
WIND SPEED CONVERSIONS[a]

V_{ult}	110	115	120	130	140	150	160	170	180	190	200
V_{asd}	85	89	93	101	108	116	124	132	139	147	155

a. Linear interpolation is permitted

R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, townhouses or other structures are to be constructed as part of a subdivision, master-planned community, or otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based upon the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided their construction is expected to begin within one year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

~~1. Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.~~

1~~2~~. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.

2~~3~~. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat, open country and grasslands.

3~~4~~. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water for a distance of at least 5000 feet (1,524 m) ~~1 mile (1.61 km). Shorelines in Exposure D include inland waterways, the Great Lakes, and coastal areas of California, Oregon, Washington and Alaska~~. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 600 feet (183 m) ~~1500 feet (457 m)~~ or 20 ~~10~~ times the height of the building or structure, whichever is greater. This category includes smooth mud flats, salt flats and unbroken ice.

~~TABLE R301.2.1.5.1~~
~~BASIC WIND MODIFICATION FOR TOPOGRAPHIC WIND EFFECT~~

TABLE R301.2.1.5.1
BASIC WIND MODIFICATION FOR TOPOGRAPHIC WIND EFFECT[a]

BASIC WIND SPEED FROM FIGURE R301.2(4)	AVERAGE SLOPE OF THE TOP HALF OF HILL, RIDGE OR ESCARPMENT (percent)						
	0.10	0.125	0.15	0.175	0.20	0.23	0.25
	Required Basic Wind Speed, Modified for Topographic Wind Speed-Up (rounded)						
110	132	137	142	147	152	158	162
115	138	143	148	154	159	165	169
120	144	149	155	160	166	172	176
130	156	162	168	174	179	N/A	N/A
140	168	174	181	N/A	N/A	N/A	N/A
150	180	N/A	N/A	N/A	N/A	N/A	N/A

a. Table applies to a feature height of 500 feet or less and dwellings sited a distance equal or greater than half the feature height.

TABLE R301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD)(psf)[a, b, c, d, e]

	ZONE	EFFECTIVE WIND AREA (feet2)	ULTIMATE DESIGN WIND SPEED, V_{ULT} (mph)																	
			110		115		120		130		140		150		160		170		180	
Roof 0 to 7 degrees	1	10	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-35.0
	1	20	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.2	-	10.6	-	11.9	-	13.3	34.1
	1	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	8.5	-	10.0	-	10.8	-	12.2	-32.9
	1	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	7.8	-	10.0	-	10.0	-	11.3	-32.0
	2	10	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-58.7
	2	20	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.2	-	10.6	-	11.9	-	13.3	-52.4
	2	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	8.5	-	10.0	-	10.8	-	12.2	-44.1
	2	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	7.8	-	10.0	-	10.0	-	11.3	-37.9
	3	10	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-88.3
	3	20	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.2	-	10.6	-	11.9	-	13.3	-73.1
	3	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	8.5	-	10.0	-	10.8	-	12.2	-53.1
	3	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	7.8	-	10.0	-	10.0	-	11.3	-37.9
Roof > 7 to 27 degrees	1	10	10.0	-	10.0	-	10.0	-	10.5	-	12.2	-	14.0	-	15.9	-	17.9	-	20.2	-32.0
	1	20	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.8	-	14.5	-	16.4	-	18.4	-31.1
	1	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.7	-	14.3	-	16.0	-29.9
	1	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-29.0
	2	10	10.0	-	10.0	-	10.0	-	10.5	-	12.2	-	14.0	-	15.9	-	17.9	-	20.2	-55.8
	2	20	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.8	-	14.5	-	16.4	-	18.4	-51.2
	2	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.7	-	14.3	-	16.0	-45.4

	2	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-40.9
	3	10	10.0	-	10.0	-	10.0	-	10.5	-	12.2	-	14.0	-	15.9	-	17.9	-	20.2	-82.4
	3	20	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.8	-	14.5	-	16.4	-	18.4	-77.0
	3	50	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	11.1	-	12.7	-	14.3	-	16.0	-69.9
	3	100	10.0	-	10.0	-	10.0	-	10.0	-	10.0	-	9.9	-	11.2	-	12.6	-	14.2	-64.6
Roof > 27 to 45 degrees	1	10	11.9	-	13.1	-	14.2	-	16.7	-	19.4	-	22.2	-	25.3	-	28.5	-	32.0	-35.0
	1	20	11.6	-	12.7	-	13.8	-	16.2	-	18.8	-	21.6	-	24.6	-	27.7	-	31.1	-33.2
	1	50	11.2	-	12.2	-	13.3	-	15.6	-	18.1	-	20.8	-	23.6	-	26.7	-	29.9	-30.8
	1	100	10.9	-	11.9	-	12.9	-	15.1	-	17.6	-	20.2	-	22.9	-	25.9	-	29.0	-29.0
	2	10	11.9	-	13.1	-	14.2	-	16.7	-	19.4	-	22.2	-	25.3	-	28.5	-	32.0	-40.9
	2	20	11.6	-	12.7	-	13.8	-	16.2	-	18.8	-	21.6	-	24.6	-	27.7	-	31.1	-39.1
	2	50	11.2	-	12.2	-	13.3	-	15.6	-	18.1	-	20.8	-	23.6	-	26.7	-	29.9	-36.8
	2	100	10.9	-	11.9	-	12.9	-	15.1	-	17.6	-	20.2	-	22.9	-	25.9	-	29.0	-35.0
	3	10	11.9	-	13.1	-	14.2	-	16.7	-	19.4	-	22.2	-	25.3	-	28.5	-	32.0	-40.9
	3	20	11.6	-	12.7	-	13.8	-	16.2	-	18.8	-	21.6	-	24.6	-	27.7	-	31.1	-39.1
	3	50	11.2	-	12.2	-	13.3	-	15.6	-	18.1	-	20.8	-	23.6	-	26.7	-	29.9	-36.8
	3	100	10.9	-	11.9	-	12.9	-	15.1	-	17.6	-	20.2	-	22.9	-	25.9	-	29.0	-35.0
Wall	4	10	13.1	-	14.3	-	15.5	-	18.2	-	21.2	-	24.3	-	27.7	-	31.2	-	35.0	-37.9
	4	20	12.5	-	13.6	-	14.8	-	17.4	-	20.2	-	23.2	-	26.4	-	29.7	-	33.4	-36.4
	4	50	11.7	-	12.8	-	13.9	-	16.3	-	19.0	-	21.7	-	24.7	-	27.9	-	31.3	-34.3
	4	100	11.1	-	12.1	-	13.2	-	15.5	-	18.0	-	20.6	-	23.5	-	26.5	-	29.8	-32.7
	4	500	10.0	-	10.6	-	11.6	-	13.6	-	15.8	-	18.1	-	20.6	-	23.2	-	26.1	-29.0
	5	10	13.1	-	14.3	-	15.5	-	18.2	-	21.2	-	24.3	-	27.7	-	31.2	-	35.0	-46.8
	5	20	12.5	-	13.6	-	14.8	-	17.4	-	20.2	-	23.2	-	26.4	-	29.7	-	33.4	-43.7
	5	50	11.7	-	12.8	-	13.9	-	16.3	-	19.0	-	21.7	-	24.7	-	27.9	-	31.3	-39.5
	5	100	11.1	-	12.1	-	13.2	-	15.5	-	18.0	-	20.6	-	23.5	-	26.5	-	29.8	-36.4
	5	500	10.0	-	10.6	-	11.6	-	13.6	-	15.8	-	18.1	-	20.6	-	23.2	-	26.1	-29.0

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

Notes:

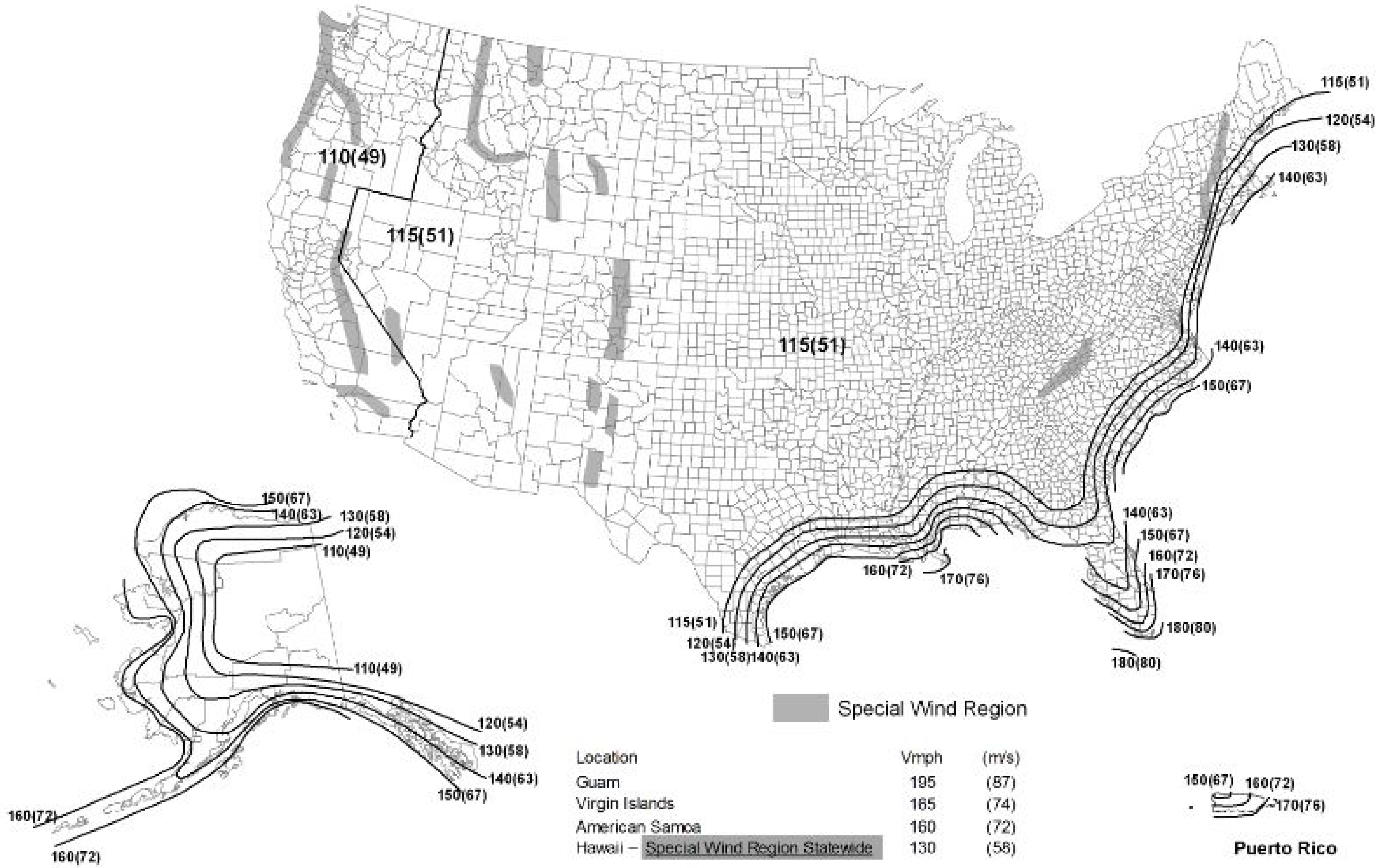
a. The effective wind area shall be equal to the span length multiplied by an effective width. This width shall be permitted to be not be less than one-third the span length. For cladding fasteners, the effective wind area shall not be greater than the area that is tributary to an individual fastener.

b. For effective areas between those given above, the load may be interpolated; otherwise, use the load associated with the lower effective area.

c. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table R301.2(3).

d. See Figure R301.2(7) for location of zones.

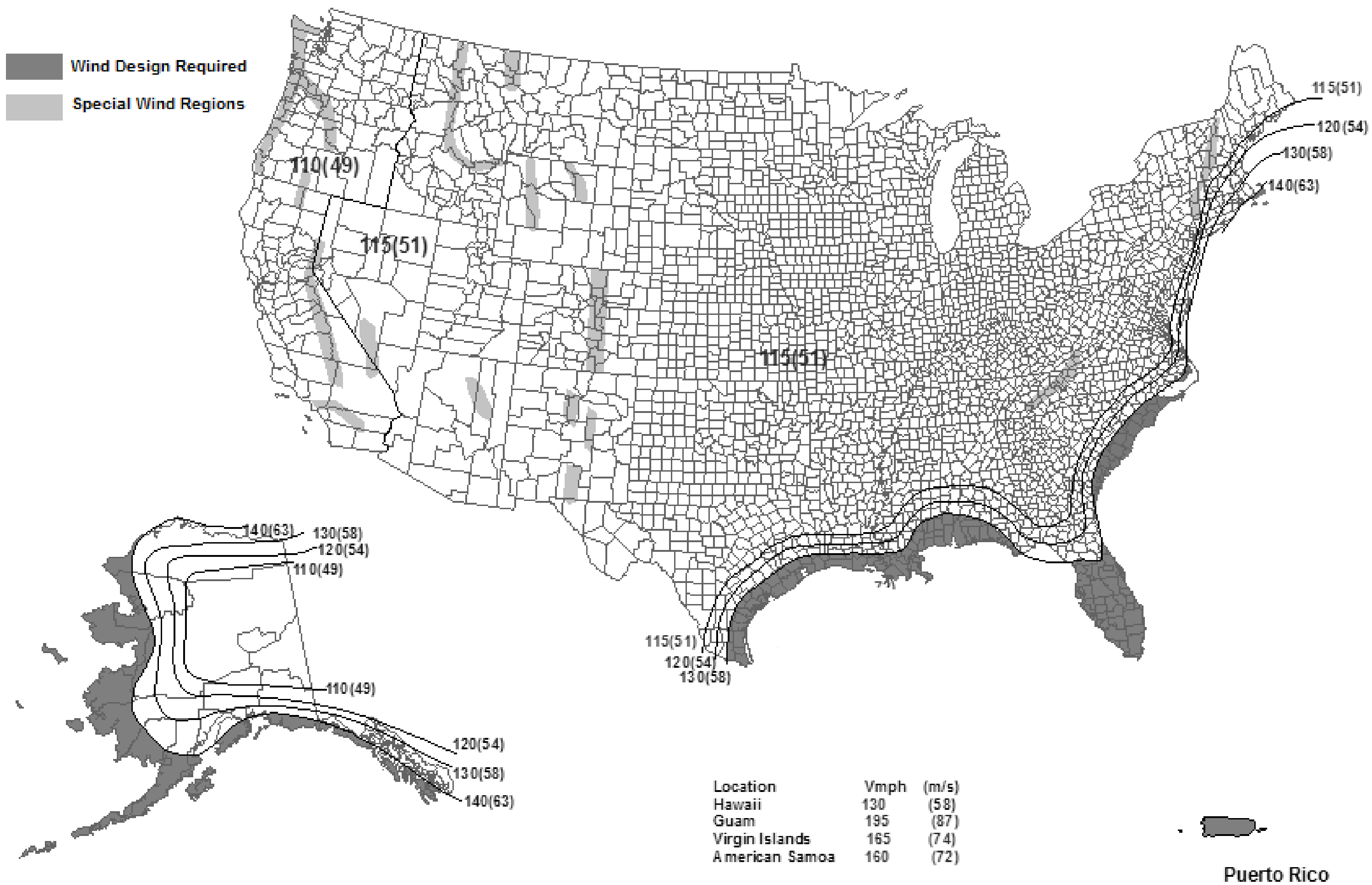
e. Plus and minus signs signify pressures acting toward and away from the building surfaces.



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).

FIGURE R301.2(4)A
ULTIMATE DESIGN WIND SPEEDS



Notes:
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years.

FIGURE R301.2(4)B
REGIONS WHERE WIND DESIGN IS REQUIRED

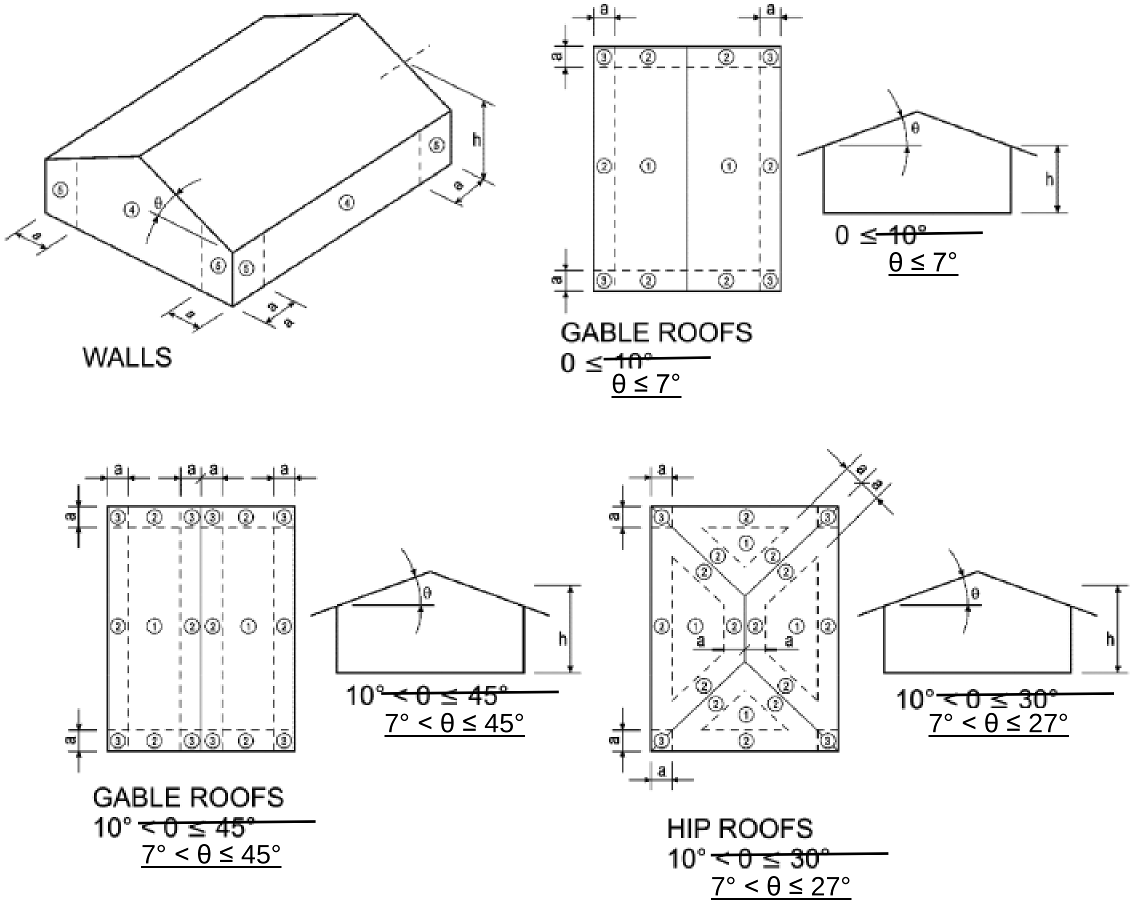


FIGURE R301.2(7)
COMPONENT AND CLADDING PRESSURE ZONES

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS[a, b, c, d, e]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Exterior walls[a] ~~— wind loads[a]~~ with plaster or stucco finish	H/360
Exterior walls[a] with other brittle finishes	H/240
Exterior walls[a] with flexible finishes	H/120[d]
Lintels supporting masonry veneer walls [e]	L/600

Note: L = span length, H = span height.

a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding (ASD) loads obtained from Table R301.2(2) for the purpose of determining deflection limits herein.

(Footnotes not shown to remain unchanged.)

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle changes, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates the Chapter 3 design criteria, including definitions, a new ultimate wind speed map, a new map of the regions where special high-wind design is required, a conversion table to the nominal (ASD) wind speed basis for use with those standards which have not updated their provisions, and a revised table of component and cladding pressures.

It is noted the component and cladding pressure table is set up using the ultimate design wind speed, but reports pressures at an ASD level. That is, the listed pressures incorporate the 0.6 multiplier on wind loads per the allowable stress design load combinations shown in Section 1605.3 of the *International Building Code* and Section 2.3.2 of ASCE 7-10. This is done here and throughout this series of proposals to allow for easy adaptation of existing stock designs, construction documents and guidelines to the 2015 IRC, as the loads and pressures will be comparable to previous editions of the IRC for most sites.

The region in revised Figure R301.2(4)B where the use of alternate prescriptive high-wind standards or engineered design is required is defined using the 130mph contour along the Gulf Coast and along the southern portions of the Atlantic coast from Florida up to North Carolina. The 140mph contour is used for the northern portions of the Atlantic coast from Virginia up to Maine, and for Alaska. A 130mph trigger is also used for the assorted Caribbean and Pacific islands that are also considered part of the "hurricane-prone" region. This creates a region that approximately equals the region defined by the 110mph contour under the wind map used in the 2000 through 2009 IRC, maintains areas of Florida and the Gulf Coast traditionally outside of the prescriptive limits of the IRC, and maintains areas of New England traditionally included within the prescriptive limits of the IRC.

Code users desiring a more accurate determination in areas near or along a particular contour (or in general) can make use of the Applied Technology Council's Windspeed by Location web site (http://www.atcouncil.org/windspeed/) to obtain site-specific wind speeds using latitude/longitude or site address. This site was developed by ATC using the same data used to develop the wind maps for ASCE 7, the IBC and the IRC. As the site is not a reference standard or maintained by a government agency, we could not make a direct reference in the code figures. However, we include mention of the Windspeed by Location web site here to draw code users' attention to its existence and in hopes that mention of the web site could become part of the IRC Commentary.

Cost Impact: The code change proposal will not increase the cost of construction.

RB39-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1-RB-EHRLICH

RB40 – 13
R301.2.1.1.1 (New), Chapter 44

Proponent: Julie Ruth, P.E., JRuth Code Consulting, representing the American Architectural Manufacturers Association (julruth@aol.com); Daniel J. Walker, P.E., Thomas Associates, representing the National Sunroom Association

Add new text as follows:

R301.2.1.1.1 Sunrooms. Sunrooms shall comply with the wind loads, structural requirements and testing provisions of Section 5.2.1 of AAMA/NPEA/NSA 2100, with the following modifications:

1. Basic wind speed in miles per hour (mph) shall be determined in accordance with Section R301.2.1 of this code; and
2. Sunrooms including exposed structure, components, cladding, and roof covering shall be designed to resist the wind loads as established in Section R301.2.1 of this code.

For the purpose of applying the criteria of AAMA/NPEA/NSA-2100 based on the intended use, sunrooms shall be identified as one of the following categories by the permit applicant, design professional or the property owner in the *construction documents*. Component and Cladding pressures shall be used for the design of elements that do not qualify as main wind force resisting systems. Main wind force resisting systems pressures shall be used for the design of elements assigned to provide support and stability for the overall *sunroom*.

Category I: A *Thermally Isolated Sunroom* with walls that are open or enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is nonhabitable and unconditioned.

Category II: A *Thermally Isolated Sunroom* with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The space is nonhabitable and unconditioned.

Category III: A *Thermally Isolated Sunroom* with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The sunroom fenestration complies with additional requirements for air infiltration resistance and water-penetration resistance. The space is nonhabitable and unconditioned.

Category IV: A *Thermally Isolated Sunroom* with enclosed walls. The sunroom is designed to be heated or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance, and thermal performance. The space is nonhabitable and *conditioned*.

Category V: A *Sunroom* with enclosed walls. The sunroom is designed to be heated or cooled and is open to the main structure. The sunroom fenestration complies with additional requirements for water-penetration resistance, air infiltration resistance, and thermal performance. The space is *habitable* and *conditioned*.

Add standards to Chapter 44 as follows:

AAMA American Architectural Manufacturers Association
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173

AAMA/NSA/NPEA 2100-12 Specifications for Sunrooms

NSA National Sunroom Association
1300 Sumner Ave.
Cleveland, OH 44115-2851

AAMA/NSA/NPEA 2100-12 Specifications for Sunrooms

NPEA National Sunroom Association
1300 Sumner Ave.
Cleveland, OH 44115-2851

AAMA/NSA/NPEA 2100-12 Specifications for Sunrooms

Reason: The 2012 *International Residential Code* defines a sunroom as "A one-story structure attached to a *dwelling* with a *glazing area* in excess of 40 percent of the gross area of the structure's *exterior walls* and roof." These structures are typically constructed in one of two manners: 1) using typical wood framing techniques, or 2) using a stick system that consists of prefabricated framing of aluminum, fiberglass, wood or other materials, with glass or opaque wall or roof panels, and steel or aluminum connections.

The first technique can be done in accordance with the current provisions of the IRC for wood framed construction. There are no provisions in the IRC for the second method of constructing a sunroom other than by engineering analysis or demonstrating equivalence to the current provisions of the *International Residential Code* by some other means.

This proposal seeks to clarify the requirements for sunrooms under the IRC by adding reference to the provisions of AAMA/NPEA/NSA 2100 - 12 *Specifications for Sunrooms* to the available options for approval of sunroom construction in the IRC. Sunrooms designed and constructed in accordance with AAMA/NPEA/NSA 2100 are required within the standard to meet the structural provisions of the IRC or the IBC. Therefore, the appropriate engineering analysis has already been conducted for these structures. In addition, the standard establishes the specific requirements for these unique structures based upon their designated Category.

In 2002 the American Architectural Manufacturers Association (AAMA), the National Sunroom Association (NSA) and the National Patio Enclosure Association (NPEA) published the first U.S. standard for the design and specification of sunrooms – AAMA/NPEA/NSA 2100 – 02. The standard established five categories of sunrooms based upon the intended use of the space, and established specific design and performance criteria for them based on the end use.

As the document began to be used and referenced in various local codes (such as the Florida Building Code) the members of the AAMA Sunroom Council and NSA became aware that improvements and updates were needed. These improvements included revisions that would bring the document in line with the requirements of AAMA/WDMA/CSA 101/I.S.2/A440 for the design, testing and labeling of windows, glass doors and skylights, and revisions that would bring the foundation requirements more closely in line with the requirements of the *International Residential Code*. The most recent edition of the standard is AAMA/NPEA/NSA 2100-12. The table below provides an overview of the requirements of AAMA/NPEA/NSA 2100-12, as they apply to the various categories of sunrooms.

Minimum Requirements	Cat. I	Cat. II	Cat. III	Cat. IV	Cat. V
Structural Design in accordance with IRC or IBC.	x	x	x	x	x
Fenestration products comply with AAMA/WDMA/CSA 101/I.S.2/A440 (includes resistance to air leakage, water penetration, forced entry, etc. as well as structural design pressure rating).		x	x	x	x
Comply with IECC or IRC Chapter 11.				x	x
Comply with the Foundation/footings, site location, and emergency escape and rescue openings requirements of the IRC or local code.	x	x	x	x	x
Emergency escape and rescue openings are permitted to open onto sunroom.	x				
Comply with the natural lighting requirements of the IRC or local code.	x	x	x	x	x
Openings for natural lighting are permitted to open onto sunroom.	x				
Comply with the requirements of the IRC or local code for stairway and egress illumination.	x	x	x	x	x
Required to have exit lighting.		x	x	x	x
Receptacle outlets as required by NFPA 70, Article 314.				x	x

The 2002 edition of AAMA/NPEA/NSA 2100 has been used successfully in previous editions of the Florida Building Code. Reference to the 2012 edition in the 2015 IRC to facilitate its use on a nationwide basis is appropriate at this time.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, [AAMA/NSA/NPEA 2100-12] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB40-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.1.1 (NEW)-RB-RUTH-WALKER

RB41 – 13
R301.2.1.2

Proponent: Edward L. Keith, APA, representing The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R301.2.1.2 Protection of openings. ~~Exterior openings in buildings located in windborne debris regions shall be protected from windborne debris.~~ Windows in buildings located in windborne debris regions shall have glazed openings protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 referenced therein. ~~The applicable wind Zones for establishing missile types in ASTM E 1996 are shown on Figure R301.2(4)C.~~ Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact resisting standard or ANSI/DASMA 115.

> **Exception:** Wood structural panels with a minimum thickness of 7/16 inch (11 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less. ~~one- and two-story buildings~~. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2(2) or ASCE 7, with the permanent corrosion resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 33 feet (10 058 mm) or less where wind speeds do not exceed 130 miles per hour (58 m/s) ~~located in Wind Zones 1 and 2 in accordance with Figure R301.2(4)C~~.

Reason: This is a companion item to S99-12/13 adopted in Portland in the October Final Action Hearing.

In the early development of the SBCCI Deemed to Comply document (The precursor to the SBCCI Standard for Hurricane Resistant Residential Construction (SSTD-10) and ultimately the ICC Standard for Residential Construction in High Wind Regions (ICC 600).) limits were developed to the geometry of the structures covered by the standard. These limits included a height limit of 33 feet mean roof height. The 33 feet was based on then-current height zoning regulations, the referenced wind speed height in the contemporary ASTM wind standard, as well as height of most anemometers (wind measuring devices). As the Deemed to Comply and later documents were limited for wood buildings to two stories in height, as the standards evolved the height limit was changed from 33 feet mean roof height to simply two stories. Note that the information in the code is based on a mean roof height of 33 feet and NOT two stories. APA developed this information and it is based on 33 feet mean roof height. (APA Form Number T450, free PDF download at www.apawood.org.)

From a wind perspective only the geometry of the structure matters. Its internal make-up of floors and walls affect the *resistance* of the structure to the wind but has no impact on the load on the structure. The reason for this change is that the "two story-only" requirement puts artificial limitations on the use of the shutter provisions. This requirement has been used to limit the use of the shutter provisions from 3-story residential structures built on sloped surfaces or with the first story partially embedded in the ground. In either of the cases the mean roof height may be 33 feet or less.

From the other perspective, the geometry of a two-story house could be such that the mean roof height exceeds 33 feet. This would make the analytical basis for the shutter design incorrect.

This proposal will also eliminate the confusion in the provision that first limits the exception to two-stories and then in the last sentence of the paragraph limits it to a 33 foot mean roof height.

The provisions in the code were originally based on a mean roof height of 33 feet; the shift to two-story was an unfortunate attempt at simplifying the provisions of the early high-wind prescriptive publications. Approval of this change will correct an unintended consequence of this attempt at simplification. Please vote for approval of this provision.

Cost Impact: The code change proposal will not increase the cost of construction.

RB41-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.2-RB-KEITH

RB42 – 13
R301.2.1.2

Proponent: Julie Ruth, P.E., JRuth Code Consulting, representing the American Architectural Manufacturers Association (julruth@aol.com); Daniel J. Walker, P.E., Thomas Associates, representing the National Sunroom Association

Revise as follows:

R301.2.1.2 Protection of openings. Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 referenced therein. The applicable wind zones for establishing missile types in ASTM E 1996 are shown on Figure R301.2(4)C. Garage door glazed opening protection for windborne debris shall meet the requirements of an *approved* impact-resisting standard or ANSI/DASMA 115.

Exception<u>s</u>:

1. Wood structural panels with a minimum thickness of 7/16 inch (11 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2(2) or ASCE 7 with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 33 feet (10 058 mm) or less where located in Wind Zones 1 and 2 in accordance with Figure R301.2(4)C.
2. <u>Openings in walls enclosing sunrooms, balconies or porches constructed under existing roofs or decks are not required to be protected provided that the spaces are separated from the building interior by a wall and all openings in that separating wall are protected in accordance with this section. Such spaces shall be permitted to be designed as either partially enclosed or enclosed structures.</u>

Reason: Frequently spaces such as sunrooms, balconies or porches that are separated from the interior of a building by an exterior wall will be constructed under existing roofs or decks. There may or may not be walls enclosing these spaces, or there may only be walls on one, two or three sides of the space. Or the space may be enclosed on all four sides, but still separated from the interior space by an exterior wall.

Although the spaces are provided some degree of protection from exterior elements such as sun, wind, rain or snow by the overhead assembly, and possibly by one or more enclosure walls, they are outside the building envelope and not completely protected from the exterior elements. They are not treated as interior, habitable spaces. They are exterior spaces.

It is not appropriate to require openings in the walls that may partially or completely enclose these spaces to be protected from wind borne debris, since these are exterior spaces, the walls themselves are not required and these spaces might otherwise be subject to wind borne debris regardless of whether or not openings in any enclosing walls are breached.

This proposal adds an exception for these spaces to the existing protection of opening requirements of the IRC. The exception is limited to spaces that are separated from the building interior by a wall whose openings are protected from wind borne debris. For the purposes of the application of ASCE 7, the enclosures of these spaces are to be designed as either partially or completely enclosed structures.

Cost Impact: None.

RB42-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.2-RB-RUTH

RB43 – 13

Tables R301.2.1.2, R602.3(2), R602.3.1, R602.3(3), R602.10.1.3, R602.10.3(1), R602.10.4, R602.10.5, R602.10.6.1, R603.3.1, R603.3.2(2), R603.3.2.1(1) through (4), R603.8, R611.6(1) through (4) and R613.5(1); and Sections R505.1.1, R602.10.6.5.1, R602.10.8.2, R603.1.1, R603.9.4.1, R611.2, R613.2, R802.10.2.1, R804.1.1, R804.3.2.1, R804.3.3 and R905.3.7

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

TABLE R301.2.1.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE
FOR WOOD STRUCTURAL PANELS

(Portions of table not shown remain unchanged)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N,
1 mile per hour = 0.447 m/s.

a. This table is based on a 130mph basic wind speeds~~s~~ and a 33-foot mean roof height.

b through d *(No change to current text)*

Revise as follows:

R505.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel floor framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist span, not greater than 40 feet (12 192 mm) in width parallel to the joist span, and less than or equal to three stories above *grade* plane. Cold-formed steel floor framing constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the basic ~~design~~ wind speed is not greater than ~~of~~ 110 miles per hour (49 m/s), the Exposure Category is B or C, and the ~~a maximum~~ ground snow load is not greater than ~~of~~ 70 pounds per square foot (3.35 kPa).

Revise as follows:

TABLE R602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS[b, c, d] ~~EXPOSED TO WIND SPEEDS OF 100 mph OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C, D0, D1 and D2~~

(Portions of table not shown remain unchanged)

a. Design required.

b. Table is limited to buildings located where the basic wind speed is 100mph or less and for which the seismic design category is A, B, C, D0, D1, or D2

c~~b~~. Applicability of this table assumes the following: Snow load not exceeding 25 psf, *fb* not less than 1310 psi determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine, E not less than 1.6 × 106 psi, tributary dimensions for floors and roofs not exceeding 6 feet, maximum span for floors and roof not exceeding 12 feet, eaves not over 2 feet in dimension and exterior sheathing. Where the conditions are not within these parameters, design is required.

d~~c~~. Utility, standard, stud and No. 3 grade lumber of any species are not permitted.

TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)

(Portions of table not shown remain unchanged)

a through f *(No change to current text)*

g. Specified alternate attachments for roof sheathing shall be permitted for basic wind speeds less than 100 mph. Fasteners attaching wood structural panel roof sheathing to gable end wall framing shall be installed using the spacing listed for panel edges.

TABLE R602.3(3)
REQUIREMENTS FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES [a, b, c]

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM BASIC WIND SPEED (mph)		
							Wind exposure category		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	B	C	D

(Portions of table not shown remain unchanged)

TABLE R602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind bracing	Basic wind speed 85mph to 110 mph	Detached, Townhouse	60 feet	None

(Portions of table not shown remain unchanged)

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

(Portions of table not shown remain unchanged)

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

a through b *(No change to current text)*

c. Method CS-SFB does not apply where the basic wind speed is greater than 100 mph.

TABLE R602.10.4
BRACING METHODS

(Portions of table not shown remain unchanged)

a through c *(No change to current text)*

d. Method CS-SFB does not apply in Seismic Design Categories D0, D1 and D2 and in areas where the basic wind speed exceeds 100 mph.

e. *(No change to current text)*

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD (See Table R602.10.4)		MINIMUM LENGTH [a] (in)					CONTRIBUTING LENGTH (in)
		Wall Height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
ABW	SDC A, B and C basic wind speed < 110 mph	28	32	34	38	42	48
	SDC D_o, D_1 and D_2, basic wind speed < 110 mph	32	32	34	NP	NP	

(Portions of table not shown remain unchanged.)

TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD DOWN FORCE (lb)				
		Height of Braced Wall Panel				
		8 ft	9 ft	10 ft	11 ft	12 ft
SDC A, B and C Basic w ~~W~~ind speed < 110 mph	One story	1800	1800	1800	2000	2200
	First of two story	3000	3000	3000	3300	3600
SDC D_0, D_1 and D_2 Basic w ~~W~~ind speed < 110 mph	One story	1800	1800	1800	NP [a]	NP [a]
	First of two story	3000	3000	3000	NP [a]	NP [a]

(Portions of table not shown remain unchanged.)

R602.10.6.5.1 Length of bracing. The length of bracing along each braced wall line shall be the greater of that required by the basic ~~design~~ wind speed and braced wall line spacing in accordance with Table R602.10.3(1) as adjusted by the factors in the Table R602.10.3(2) or the Seismic Design Category and braced wall line length in accordance with Table R602.10.6.5. Angled walls shall be permitted to be counted in accordance with Section R602.10.1.4, and braced wall panel location shall be in accordance with Section R602.10.2.2. The seismic adjustment factors in Table R602.10.3(4) shall not be applied to the length of bracing determined using Table R602.10.6.5. In no case shall the minimum total length of bracing in a braced wall line, after all adjustments have been taken, be less than 48 inches (1219 mm) total.

R602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the braced wall panels shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously-sheathed braced wall lines. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with Section R806.1.

1. For Seismic Design Categories A, B and C and basic wind speeds less than 100 mph (45 m/s) where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 91/4 inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is between 91/4 inches (235 mm) and 151/4 inches (387 mm), blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).
2. For Seismic Design Categories D0, D1 and D2 or basic wind speeds of 100 mph (45 m/s) or greater, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses is 151/4 inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).
3. Where the distance from the top of the *braced wall panel* to the top of rafters or roof trusses exceeds $15^{1}/_{4}$ inches (387 mm), the top plates of the *braced wall panel* shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:
    - 3.1. Soffit blocking panels constructed in accordance with Figure R602.10.8.2(2);
    - 3.2. Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3);
    - 3.3. Full-height engineered blocking panels designed in accordance with the AF&PA WFCM; or
    - 3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with accepted engineering practice.

R603.1.1 Applicability limits. The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above *grade plane*. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the basic ~~design~~ wind speed is not greater than ~~of~~ 110 miles per hour (49 m/s), the Exposure Category is B or C, and the ~~a maximum~~ ground snow load is not greater than ~~of~~ 70 pounds per square foot (3.35 kPa).

TABLE R603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS [a,b]

FRAMING CONDITION	BASIC WIND SPEED (mph) AND EXPOSURE					
	85 B	90 B	100 B 85 C	110 B 90C	100 C	< 110 C

(Portions of table not shown remain unchanged.)

TABLE R603.3.2(2)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c]
33 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)		
				8-foot Studs	9-foot Studs	10-foot Studs
Exp. B	Exp. C			Ground Snow Load (psf)		

(Portions of table not shown remain unchanged.)

TABLE R603.3.2(31)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a, b, c]
50 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)		
				8-foot Studs	9-foot Studs	10-foot Studs
Exp. B	Exp. C			Ground Snow Load (psf)		

(Portions of table not shown remain unchanged.)

TABLE R603.3.2.1(1)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT[a, b, c]
33 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)		
Exp. B	Exp. C			8-foot Studs	9-foot Studs	10-foot Studs

(Portions of table not shown remain unchanged.)

(TABLE R603.3.2.1(2)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT[a, b, c]
50 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)		
Exp. B	Exp. C			8-foot Studs	9-foot Studs	10-foot Studs

(Portions of table not shown remain unchanged.)

TABLE R603.3.2.1(3)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT[a, b, c]
33 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)					
				Stud Height, *h* (feet)					
Exp. B	Exp. C			10 < *h* □ 12	12 < *h* □ 14	14 < *h* □ 16	16 < *h* □ 18	18 < *h* □ 20	20 < *h* □ 22

(Portions of table not shown remain unchanged.)

TABLE R603.3.2.1(4)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT[a, b, c]
50 KSI STEEL

BASIC WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)					
				Stud Height, *h* (feet)					
Exp. B	Exp. C			10 < *h* □ 12	12 < *h* □ 14	14 < *h* □ 16	16 < *h* □ 18	18 < *h* □ 20	20 < *h* □ 22

(Portions of table not shown remain unchanged.)

TABLE R603.8
HEAD AND SILL TRACK SPAN

(Portions of table not shown remain unchanged.)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Deflection limit: *L*/240.

b. Head and sill track spans are based on components and cladding wind pressures ~~speeds~~ and 48 inch tributary span.

c. For openings less than 4 feet in height that have both a head track and sill track, the above spans are permitted to be multiplied by 1.75. For openings less than or equal to 6 feet in height that have both a head track and a sill track, the above spans are permitted to be multiplied by a factor of 1.5.

R603.9.4.1 Wind speeds greater than 100 mph. Where the basic wind speed~~s are in excess of~~ exceeds 100 miles per hour (45 m/s) and~~,~~ Exposure C or D applies, walls shall be provided with ~~wind~~ direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F7.2, as required for 110 miles per hour (49 m/s), Exposure C.

R611.2 Applicability limits. The provisions of this section shall apply to the construction of exterior concrete walls for buildings not greater than 60 feet (18 288 mm) in plan dimensions, floors with clear spans not greater than 32 feet (9754 mm) and roofs with clear spans not greater than 40 feet (12 192 mm). Buildings shall not exceed 35 feet (10 668 mm) in mean roof height or two stories in height above-grade. Floor/ceiling dead loads shall not exceed 10 pounds per square foot (479 Pa), roof/ceiling dead loads shall not exceed 15 pounds per square foot (718 Pa) and *attic* live loads shall not exceed 20 pounds per square foot (958 Pa). Roof overhangs shall not exceed 2 feet (610 mm) of horizontal projection beyond the exterior wall and the dead load of the overhangs shall not exceed 8 pounds per square foot (383 Pa).

Walls constructed in accordance with the provisions of this section shall be limited to buildings ~~subjected to a maximum~~ where the basic ~~design~~ wind speed is not greater than ~~of~~ 130 miles per hour (58 m/s) Exposure B, 110 miles per hour (49 m/s) Exposure C and 100 miles per hour (45 m/s) Exposure D. Walls constructed in accordance with the provisions of this section shall be limited to detached one- and two-family *dwellings* and townhouses assigned to Seismic Design Category A or B, and detached one- and two-family *dwellings* assigned to Seismic Design Category C.

TABLE R611.6(1)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT ABOVE-GRADE WALLS [a, b, c, d, e]

BASIC ~~MAXIMUM~~ WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)[f, g]							
Exposure Category				Nominal[h] wall thickness (inches)							
				4		6		8		10	
B	C	D		Top[i]	Side[i]	Top[i]	Side[i]	Top[i]	Side[i]	Top[i]	Side[i]

(Portions of table not shown remain unchanged.)

TABLE R611.6(2)
MINIMUM VERTICAL REINFORCEMENT FOR WAFFLE-GRID ABOVE-GRADE WALLS[a, b, c, d, e]

BASIC ~~MAXIMUM~~ WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]			
				Nominal[h] wall thickness (inches)			
Exposure Category				6		8	
B	C	D		Top[i]	Side[i]	Top[i]	Side[i]

(Portions of table not shown remain unchanged.)

TABLE R611.6(3)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH SCREEN-GRID ABOVE-GRADE WALLS[a, b, c, d, e]

BASIC ~~MAXIMUM~~ WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]	
				Nominal[h] wall thickness (inches)	
Exposure Category				6	
B	C	D		Top[i]	Side[i]

(Portions of table not shown remain unchanged.)

TABLE R611.6(4)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID ABOVE-GRADE WALLS DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS[a, b, c, d, e, k, l]

BASIC ~~MAXIMUM~~ WIND SPEED (mph)			HEIGHT OF STEM WALL[h, i] (feet)	MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)	MAXIMUM UNSUPPORTED HEIGHT OF ABOVE-GRADE WALL (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]						
						Wall type and nominal thickness[j] (inches)						
Exposure Category						Flat				Waffle		Screen
B	C	D				4	6	8	10	6	8	6

(Portions of table not shown remain unchanged.)

R613.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites where the basic ~~subjected to a maximum design~~ wind speed is not greater than ~~of~~ 130 miles per hour (58 m/s), the

Exposure Category is A, B or C, ~~and a maximum~~ the ground snow load is not greater than ~~of~~ 70 pounds per foot (3.35 kPa), and the Seismic Design Category is ~~Categories~~ A, B, or ~~and~~ C.

TABLE R613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP LIGHT-FRAME ROOF ONLY (inches)

BASIC WIND SPEED ~~(3-second gust)~~ (mph)		**SNOW LOAD (psf)**	**MINIMUM STUD THICKNESS (mils)**														
			24			**28**			**32**			**36**			**40**		
			Wall Height (ft)			**Wall Height (ft)**			**Wall Height (ft)**			**Wall Height (ft)**			**Wall Height (ft)**		
Exp. A/B	**Exp. C**		**8**	**9**	**10**	**8**	**9**	**10**	**8**	**9**	**10**	**8**	**9**	**10**	**8**	**9**	**10**

(Portions of table not shown remain unchanged.)

Revise as follows:

R802.10.2.1 Applicability limits. The provisions of this section shall control the design of truss roof framing when snow controls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span, not greater than two stories in height with each *story* not greater than 10 feet (3048 mm) high, and roof slopes not smaller than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the basic ~~design~~ wind speed is not greater than ~~of~~ 110 miles per hour (49 m/s), the Exposure Category is A, B or C, and the ~~a maximum~~ ground snow load is not greater than ~~of~~ 70 pounds per square foot (3.35 kPa). For consistent loading of all truss types, roof snow load is to be computed as: 0.7 *p*g.

R804.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm)in width parallel to the joist span or truss, less than or equal to three stories above *grade* plane and with roof slopes not less than 3:12 (25-percent slope) or greater than 12:12 (100 percent slope). Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the basic ~~design~~ wind speed is not greater than ~~of~~ 110 miles per hour (49 m/s), the Exposure Category is B or C, and the ~~a maximum~~ ground snow load is not greater than ~~of~~ 70 pounds per square foot (3.35 kPa).

R804.3.2.1 Minimum roof rafter sizes. Roof rafter size and thickness shall be determined in accordance with the limits set forth in Tables R804.3.2.1(1) and R804.3.2.1(2) based on the horizontal projection of the roof rafter span. For determination of roof rafter sizes, reduction of roof spans shall be permitted when a roof rafter support brace is installed in accordance with Section R804.3.2.2. The reduced roof rafter span shall be taken as the larger of the distance from the roof rafter support brace to the ridge or to the heel measured horizontally.

For the purpose of determining roof rafter sizes in Tables R804.3.2.1(1) and R804.3.2.1(2), basic wind speeds shall be converted to equivalent ground snow loads in accordance with Table R804.3.2.1(3). Roof rafter sizes shall be based on the higher of the ground snow load or the equivalent snow load converted from the basic wind speed.

R804.3.3 Hip framing. Hip framing shall consist of jack-rafters, hip members, hip support columns and connections in accordance with this section, or shall be in accordance with an *approved* design. The provisions of this section for hip members and hip support columns shall apply only where the jack rafter slope is greater than or equal to the roof slope. For the purposes of determining member sizes in this section, basic wind speeds shall be converted to equivalent ground snow load in accordance with Table R804.3.2.1(3).

Revise as follows:

R905.3.7 Application. Tile shall be applied in accordance with this chapter and the manufacturer's installation instructions, based on the following:

Clay and concrete roof tiles shall be fastened in accordance with this section and the manufacturer's installation instructions. Perimeter tiles shall be fastened with a minimum of one fastener per tile. Tiles with installed weight less than 9 pounds per square foot (0.4 kg/m2) require a minimum of one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer's installation instructions where applied in areas where the <u>basic</u> wind speed exceeds 100 miles per hour (45 m/s) and on buildings where the roof is located more than 40 feet (12 192 mm) above *grade*. In areas subject to snow, a minimum of two fasteners per tile is required. In all other areas, clay and concrete roof tiles shall be attached in accordance with Table R905.3.7.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The purpose of this proposal is to coordinate terminology in the code. Figure R301.2.4(A) supplies the "basic wind speed", defined as the "three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section R301.2.1). This wind speed, derived from ASCE 7, is a design wind speed based on an extensive modeling process using historical data, wind characteristics and computer simulations. It is not necessarily the "maximum" wind speed that can be experienced by a site, nor does it suggest the "maximum" wind speed an element is capable of resisting due to factors of safety in material standards and design procedures. This proposal corrects references throughout the IRC to properly refer to "basic wind speed."

Cost Impact: None

RB43-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.2T-RB-BAJNAI-BCAC

RB44 – 13

R301.2.1.4, R603.3.2, R613.2, Table R613.5(1), Table R613.5(2), R802.10.2.1

Proponent: Matthew L. Mlakar, Barrish Pelham and Associates, Inc., representing Structural Engineers Association of California

Revise as follows:

R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, *townhouses* or other structures are to be constructed as part of a subdivision, master-planned community, or otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based upon the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided their construction is expected to begin within one year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

~~1. Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.~~

1~~2~~. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.

2~~3~~. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country and grasslands.

3~~4~~. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water for a distance of at least 1 mile (1.61 km). Shorelines in Exposure D include inland waterways, the Great Lakes, and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1500 feet (457 m) or 10 times the height of the building or structure, whichever is greater.

Revise as follows:

R603.3.2 Minimum stud sizes. Cold-formed steel walls shall be constructed in accordance with Figures R603.3.1(1), R603.3.1(2), or R603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(31). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through 603.3.2(31) based upon an 85 miles per hour (38 m/s) Exposure ~~A/~~B wind value and the building width, stud spacing and snow load, as appropriate. Fastening requirements shall be in accordance with Section R603.2.4 and Table R603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs.

(*No change to remaining text)*

R613.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 120 miles per hour (54 m/s), Exposure ~~A or~~ B or, 110 miles per hour (49 m/s) Exposure C, and a maximum ground snow load of 70 pounds per foot (3.35 kPa), and Seismic Design Categories A, B, and C.

TABLE R613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP LIGHT-FRAME ROOF ONLY (inches)[a]

Building Width (ft)							
Wind Speed (3-sec gust)		Snow Load (psf)	24	28	32	36	40
Exp ~~A/~~B	Exp. C		Wall Height (feet)	Wall Height (feet)	Wall Height (feet)	Wall Height (feet)	Wall Height (feet)

(Portions of table not shown to remain unchanged.)

TABLE R613.5(2)
MINIMUM THICKNESS FOR SIP WALLS SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF (inches)[a]

Building Width (ft)							
Wind Speed (3 –sec gust)		Snow Load (psf)	24	28	32	36	40
Exp ~~A/~~B	Exp. C		Wall Height (feet)	Wall Height (feet)	Wall Height (feet)	Wall Height (feet)	Wall Height (feet)

(Portions of table not shown to remain unchanged.)

Revise as follows:

R802.10.2.1 Applicability limits. The provisions of this section shall control the design of truss roof framing when snow controls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span, not more than three stories above *grade plane* in height, and roof slopes not smaller than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (49 m/s), Exposure ~~A,~~ B or C, and a maximum ground snow load of 70 psf (3352 Pa). For consistent loading of all truss types, roof snow load is to be computed as: 0.7 p_g.

Reason: Exposure category A is no longer listed as an exposure category under ASCE 7-10 section 26.7.3, nor is it used in the current edition of the IBC. Most of the references to Exposure A have been removed from the IRC, however, a few still remain. The four sections and two tables included in this proposal represent the remaining locations where Exposure A is referenced.
The removal of Exposure A will bring the IRC in line with the IBC and industry standards.

Cost Impact: The proposed code change will not change the cost of construction.

RB44-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.4 #1-RB-MLAKAR

RB45 – 13
R301.2.1.4

Proponent: Matthew L. Mlakar, Barrish Pelham and Associates, Inc., representing Structural Engineers Association of California

Revise as follows:

R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, *townhouses* or other structures are to be constructed as part of a subdivision, master-planned community, or otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based upon the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided their construction is expected to begin within one year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.
2. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
3. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country and grasslands.
4. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water, smooth mud flats, salt flats and unbroken ice for a distance of at least ~~1 mile (1.61 km)~~ 5000 feet (1,524m). ~~Shorelines in Exposure D include inland waterways, the Great Lakes, and coastal areas of California, Oregon, Washington and Alaska.~~ This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the ~~water~~ unobstructed area. Exposure D extends ~~inland~~ downwind from the ~~shoreline~~ edge of the unobstructed area a distance of ~~1500 feet (457 m)~~ 600 feet (183 m) or ~~10~~ 20 times the height of the building or structure, whichever is greater.

Reason: The 2012 IRC definition for wind exposure category D does not match the definition in either the 2012 IBC or ASCE 7-10. Under ICC CP#28 policy section 1.3.1 the provisions of all codes shall be consistent with one another so that conflicts between codes do not occur. The proposed change is to incorporate the language of ASCE 7-10 section 26.7.3 into the IRC. It should be noted that ASCE 7-10 now requires the use of exposure D along hurricane coastlines. ASCE 7-10 commentary section C26.7, cites recent research which provides data showing that the surface roughness over the ocean in a hurricane is consistent with that of exposure D rather than exposure C.

The change to the exposure categories will bring the IRC in line with the IBC and industry standards.

Cost Impact: The proposal is editorial and will not impact the cost of construction.

RB45-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.4 #2-RB-MLAKAR

:

RB46 – 13
R301.2.1.4

Proponent: Andrew Herseth, US Dept of Homeland Security, Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, *townhouses* or other structures are to be constructed as part of a subdivision, master-planned community, or otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based upon the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided their construction is expected to begin within one year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

~~1.~~ ~~Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.~~

~~2.~~1. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single family dwellings or larger. Use of this exposure category shall be limited to those areas for which terrain representative of Exposure B prevails in the upwind direction for a distance of at least 1,500 feet (460 m). ~~Exposure B shall be assumed unless the site meets the definition of another type exposure.~~

~~3.~~2. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) ~~extending more than 1,500 feet (457 m) from the building site in any quadrant~~. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat, open country and grasslands. Exposure C shall be assumed unless the site meets the definition of another type exposure.

~~4.~~3. Exposure D. Flat, unobstructed areas and areas exposed to wind flowing over open water for a distance of at least 5000 feet (1524 m)~~1 mile (1.61 km)~~. Shorelines in Exposure D include inland waterways, the Great Lakes, and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 600 feet ~~1500 feet (457 m)~~ or 20 ~~10~~ times the height of the building or structure, whichever is greater.

Reason: The purpose of this proposal is simply to update the methodology in the IRC for assigning an Exposure Category to a site, so that it is consistent with ASCE 7 and the IBC. The Exposure Category definitions in the IRC are essentially described in the same way that they were in the first version (2000) of the IRC. The Exposure Category definitions in ASCE 7 were substantially updated in the 2002 to include surface roughness concepts. These changes were subsequently incorporated in the 2006 IBC. Additionally, ASCE 7 and the IBC no longer refer to Exposure A. This proposal represents a simplified approach to bring the IRC up to date with some of the more substantial changes in site Exposure determination by maintaining language consistent with earlier versions of the code.

Exposure Categories provide a way of establishing the roughness of the terrain surrounding a building. The amount and type of roughness surrounding a building can significantly impact the applicable design wind loads. All things being equal, a building sited in Exposure C would have to be designed for wind loads that are approximately 20% higher than for the same building sited in

Exposure B. Similarly, a building sited in Exposure D would have to be designed for wind loads that are approximately 20% higher than for the same building sited in Exposure C. Therefore, the determination of the most likely Exposure at the site is essential to the determination of the appropriate wind loads for a building.

More importantly, the current Exposure Category definitions result in some anomalies related to Exposure Categories B and C. For example, consider a building that had a 100 ft buffer of trees on the north face of the building. Beyond the 100 ft buffer is completely open terrain. ASCE 7 and the IBC would clearly define the Exposure Category for this site as C. However, the IRC would define this site as Exposure B. Additionally, if the north side of the building was subject to wind blowing over a length of open water that was ¾ of a mile, the code is not very clear which Exposure Category would apply. However, Exposure D would not apply to the site because the length of the water Exposure is less than 1 mile. As such, the described Exposure condition doesn't fit within the description for Exposure C as currently established by the code. Therefore, the user may default to Exposure B, when ASCE 7 and IBC would be clear that situation would qualify as Exposure C.

Lastly, ASCE 7 and the IBC differ from the IRC with regard to Exposure D. The IRC requires Exposure D to extend inland from the shoreline 1500 ft or 10 times the height of the building, whichever is greater. ASCE 7 and the IBC essentially require Exposure D to extend inland from the shoreline 600 feet or 20 times the height of the building, whichever is greater. .

Eight years ago, FEMA P-488, *Mitigation Assessment Team Report: Hurricane Charley in Florida* (FEMA, 2004), recommended that Exposure Categories used in design be defined in a manner consistent with ASCE 7-02. It noted specifically that the refinements to design guidance for Exposure Categories included in ASCE 7-02 would help ensure that full-wind loads are calculated in open areas (Exposure C) where speed reductions are not appropriate. As previously noted, while the IBC adopted the updated ASCE 7 methodology for assigning Exposure Categories in the 2006 edition, the IRC has yet to move forward and risks underestimation of wind pressure as a result.

Cost Impact: The code change proposal will not increase the cost of construction.

RB46-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.1.4-RB-HERSETH-OVERCASH

RB47 – 13
R301.2.2.2.1, Table R301.2.2.2.1

Proponent: Edward L. Keith, APA, representing The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R301.2.2.2.1 Weights of materials. Average dead loads shall not exceed 15 pounds per square foot (720 Pa) for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot (480 Pa) for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above grade shall not exceed:

1. Fifteen pounds per square foot (720 Pa) for exterior light-frame wood walls.
2. Fourteen pounds per square foot (670 Pa)for exterior light-frame cold-formed steel walls.
3. Ten pounds per square foot (480 Pa) for interior light-frame wood walls.
4. Five pounds per square foot (240 Pa) for interior light-frame cold-formed steel walls.
5. Eighty pounds per square foot (3830 Pa) for 8-inch-thick (203 mm) masonry walls.
6. Eighty-five pounds per square foot (4070 Pa) for 6-inch-thick (152 mm) concrete walls.
7. Ten pounds per square foot (480 Pa) for SIP walls.

Exceptions:

~~1. Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided the wall bracing amounts in Chapter 6 are increased in accordance with Table R301.2.2.2.1.~~

1~~2.~~ Light-frame walls with stone or masonry veneer shall be permitted in accordance with the provisions of Sections R702.1 and R703.

2~~3.~~ Fireplaces and chimneys shall be permitted in accordance with Chapter 10.

~~TABLE R301.2.2.2.1~~
~~WALL BRACING ADJUSTMENT FACTORS BY ROOF COVERING DEAD LOAD~~[a]

~~WALL SUPPORTING~~	~~ROOF/CEILING DEAD LOAD~~	
	~~15 psf or less~~	~~25 psf~~
~~Roof only~~	~~1.0~~	~~1.2~~
~~Roof plus one or two stories~~	~~1.0~~	~~1.1~~

~~For SI: 1 pound per square foot = 0.0479kPa~~

~~a. Linear interpolation shall be permitted.~~

Reason: Exception 1 proposed for deletion in this proposal calls for the adjustment of the bracing amount in Chapter 6 to be increased by the Table R301.2.2.2.1 amounts. Currently the same adjustments are duplicated in Chapter 6 in Table R602.10.3(4) for the adjustment based on: "Roof/ceiling dead load for wall supporting". The way the exception is written could require the same adjustments be applied twice; once when determining Chapter 6 bracing, and once again it comply with Section R301.2.2.2.1. Deleting the requirement in Section R301.2.2.2.1 would eliminate the potential for "double dipping" and eliminate the resulting unnecessary construction costs.

Cost Impact: This code change proposal will not increase the cost of construction.

RB47-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.2.2.1-RB-KEITH

RB48 – 13

R301.2.2.2.5, R301.2.2.1.2, R502.2.2 (New), R502.3.3.1 (New), Table R502.3.3(1), R502.10.1 (New), R602.10, R602.10.9, R603.1.1, R802.9.1, AJ104.1

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov)

Revise as follows:

~~**R301.2.2.2.5 Irregular buildings.** The seismic provisions of this code shall not be used for irregular structures located in Seismic Design Categories C, D0, D1 and D2. Irregular portions of structures shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. When the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, design of the remainder of the building shall be permitted using the provisions of this code. A building or portion of a building shall be considered to be irregular when one or more of the following conditions occur:~~

1. ~~When exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost *story* in which they are required.~~

   ~~**Exception:** For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that:~~

   1. ~~Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.~~
   2. ~~The ratio of the back span to the cantilever is at least 2 to 1.~~
   3. ~~Floor joists at ends of *braced wall panels* are doubled.~~
   4. ~~For wood-frame construction, a continuous rim joist is connected to ends of all cantilever joists. When spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 11/2 inches (38 mm) wide fastened with six 16d nails on each side of the splice or a block of the same size as the rim joist of sufficient length to fit securely between the joist space at which the splice occurs fastened with eight 16d nails on each side of the splice; and 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.~~

2. ~~When a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.~~

   ~~**Exception:** Portions of floors that do not support shear walls or *braced wall panels* above, or roofs, shall be permitted to extend no more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.~~

3. ~~When the end of a *braced wall panel* occurs over an opening in the wall below and ends at a horizontal distance greater than 1 foot (305 mm) from the edge of the opening. This provision is applicable to shear walls and *braced wall panels* offset in plane and to *braced wall panels* offset out of plane as permitted by the exception to Item 1 above.~~

   ~~**Exception:** For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) wide in the wall below provided that the opening includes a header in accordance with the following:~~

   1. ~~The building width, loading condition and framing member species limitations of Table R502.5(1) shall apply; and~~

2. ~~Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide; or~~
3. ~~Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) wide; or~~
4. ~~Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) wide; and~~
5. ~~The entire length of the *braced wall panel* does not occur over an opening in the wall below.~~

4. ~~When an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.~~
5. ~~When portions of a floor level are vertically offset.~~

~~**Exceptions:**~~

1. ~~Framing supported directly by continuous foundations at the perimeter of the building.~~
2. ~~For wood light-frame construction, floors shall be permitted to be vertically offset when the floor framing is lapped or tied together as required by Section R502.6.1.~~

6. ~~When shear walls and *braced wall lines* do not occur in two perpendicular directions.~~
7. ~~When stories above *grade* plane partially or completely braced by wood wall framing in accordance with Section R602 or steel wall framing in accordance with Section R603 include masonry or concrete construction.~~

~~**Exception:** Fireplaces, chimneys and masonry veneer as permitted by this code. When this irregularity applies, the entire *story* shall be designed in accordance with accepted engineering practice.~~

R301.2.2.1.2 Alternative determination of Seismic Design Category E. Buildings located in Seismic Design Category E in accordance with Figure R301.2(2) are permitted to be reclassified as being in Seismic Design Category D 2 provided one of the following is done:

1. A more detailed evaluation of the seismic design category is made in accordance with the provisions and maps of the International Building Code. Buildings located in Seismic Design Category E per Table R301.2.2.1.1, but located in Seismic Design Category D per the International Building Code, may be designed using the Seismic Design Category D2 requirements of this code.
2. Buildings located in Seismic Design Category E that conform to the following additional restrictions are permit-ted to be constructed in accordance with the provisions for Seismic Design Category D2 of this code:
   2.1. All exterior shear wall lines or braced wall panels are in one plane vertically from the foundation to the uppermost story.
   2.2. Floors shall not cantilever past the exterior walls.2.3. The building <u>or portions of the building are constructed in accordance with the requirements for structures assigned to Seismic Design Category D2 elsewhere in this code.</u> ~~is within all of the requirements of Section R301.2.2.2.5 for being considered as regular.~~

Revise as follows:

R502.2 Design and construction. Floors shall be designed and constructed in accordance with the provisions of this chapter, Figure R502.2 and Sections R317 and R318 or in accordance with AF&PA/NDS.

R502.2.1 Framing at braced wall lines. A load path for lateral forces shall be provided between floor framing and *braced wall panels* located above or below a floor, as specified in Section R602.10.8.

R502.2.2 Vertically offset floor diaphragms in Seismic Design Category C, D0, D1 and D2. In structures or portions of structures in Seismic Design Category C, D0, D1 and D2, floor diaphragms or portions of floor diaphragms shall not be vertically offset.

Exceptions:

1. Framing supported directly by continuous foundations at the perimeter of the building.
2. For wood light-frame construction, floors shall be permitted to be vertically offset when the floor framing is lapped or tied together as required by Section R502.6.1.

R502.3.3 Floor cantilevers. Floor cantilever spans shall not exceed the nominal depth of the wood floor joist. Floor cantilevers constructed in accordance with Table R502.3.3(1) shall be permitted when supporting a light frame bearing wall and roof only. Floor cantilevers supporting an exterior balcony are permitted to be constructed in accordance with Table R502.3.3(2).

R502.3.3.1 Floor cantilevers in Seismic Design Categories D0, D1 or D2. Floor cantilevers supporting *braced wall panels* in all structures assigned to *Seismic Design Categories* D0, D1 or D2 and in townhouses in Seismic Design Category C shall be constructed in accordance with Section R602.10.9.

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLYa, b, c, f, g, h
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)

(Potions of table not shown remain unchanged)

a through e *(No changes to text)*

f. See Section ~~R301.2.2.2.5~~ R602.10.9, Item 1, for additional limitations on cantilevered floor joists for ~~detached one- and two-family~~ dwellings in Seismic Design Category D0, D1, or D2 and townhouses in Seismic Design Category C.~~, D0, D1 or D2.~~

g through h *(No change to text)*

R502.10 Framing of openings. Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed 4 feet (1219 mm), the header joist may be a single member the same size as the floor joist. Single trimmer joists may be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header. *Approved* hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6 feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

R502.10.1 Framing of openings in Seismic Design Categories C, D0, D1 and D2. In structures in Seismic Design Category D0, D1 or D2 and in townhouses in Seismic Design Category C, where an opening in a floor exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor dimension, that portion of the structure shall be designed in accordance with accepted engineering practice to the extent that the opening affects the performance of the remaining structural system.

Revise as follows:

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

For all structures in Seismic Design Category D0, D1 or D2 and in townhouses in Seismic Design Category C, stories above *grade* plane partially or completely braced by wood wall framing in accordance with this section shall not include masonry or concrete construction or the entire *story* shall be designed in accordance with accepted engineering practice.

Exception: Fireplaces, chimneys and masonry veneer as permitted by this code.

R602.10.9 Braced wall panel support. *Braced wall panel* support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support *braced wall panel*s.

   For structures in Seismic Design Category D0, D1 and D2 and in townhouses in Seismic Design Category C, cantilevered floor joists supporting braced wall panels shall also comply with all of the following:

   1. Floor joists shall be nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   2. The ratio of the back span to the cantilever shall be at least 2 to 1.
   3. Floor joists at ends of *braced wall panels* shall be doubled.
   4. For wood-frame construction, a continuous rim joist shall be connected to ends of all cantilever joists. When spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) in thickness and 11/2 inches (38 mm) in width fastened with six 16d nails on each side of the splice or a block of the same size as the rim joist of sufficient length to fit securely between the joist space at which the splice occurs fastened with eight 16d nails on each side of the splice; and
   5. Gravity loads carried at the end of cantilevered joists shall be limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Elevated post or pier foundations supporting *braced wall panel*s shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls with a length of 48 inches (1219 mm) or less supporting *braced wall panel*s shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches (1219 mm) supporting *braced wall panel* s shall be constructed in accordance with Section R403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall have reinforcement sized and located in accordance with Figure R602.10.9.
5. For all structures in Seismic Design Category D0, D1 or D2 and in townhouses in Seismic Design Category C, the end of a *braced wall panel* over an opening in the wall below shall not extend a horizontal distance greater than 1 foot (305 mm) from the end of the panel to the edge of the opening. This provision is applicable to *braced wall panels* offset in plane and to *braced wall panels* offset out of plane as permitted by the exception to Item 1 above.

   Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) wide in the wall below provided that the opening includes a header in accordance with the following:

   1. The building width, loading condition and framing member species limitations of Table R502.5(1) shall apply; and
   2. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide; or
   3. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) wide; or
   4. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) wide; and
   5. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

R603.1.1 Applicability limits. The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above *grade plane* . All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (49 m/s) Exposure B or C and a maximum ground snow load of 70 pounds per square foot (3.35 kPa).

<u>For all structures in Seismic Design Category D0, D1 or D2 and in townhouses in Seismic Design Category C, stories above *grade* plane walls partially or completely braced by cold-formed wall framing in accordance with this section shall not include masonry or concrete construction or the entire *story* shall be designed in accordance with accepted engineering practice.</u>

<u>**Exception:** Fireplaces, chimneys and masonry veneer as permitted by this code.</u>

Revise as follows:

R802.9 Framing of openings. Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist span does not exceed 4 feet (1219 mm), the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joists or rafter framing into the header. *Approved* hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6 feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

<u>**R802.9.1 Framing of openings in Seismic Design Categories C, D0, D1 and D2.** For structures or portions of structures in Seismic Design Category C, D0, D1 or D2 when an opening in a roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least roof dimension, that portion of the structure shall be designed in accordance with accepted engineering practice to the extent the opening affects the performance of the remaining structural system.</u>

Revise as follows:

SECTION AJ104
EVALUATION OF AN EXISTING BUILDING

AJ104.1 General. The *building official* may require an existing building to be investigated and evaluated by a registered design professional in the case of proposed reconstruction of any portion of a building. The evaluation shall determine the existence of any potential non-conformities to these provisions, and shall provide a basis for determining the impact of the proposed changes on the performance of the building. The evaluation shall use the following sources of information, as applicable:

1. Available documentation of the existing building.
   1.1. Field surveys.
   1.2. Tests (nondestructive and destructive).
   1.3. Laboratory analysis.

   Exception: Detached one- or two-family dwellings that <u>comply with Section R102.7</u>. ~~are not irregular buildings under Section R301.2.2.2.5~~ and are not undergoing an extensive reconstruction shall not be required to be evaluated.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

This proposal is to delete the concept of "Irregular Structures" from Section R301.2.2.2.5 from the code and relocate the specific construction requirements of the irregular structures into the applicable sections of the code where they are relevant. As currently written, the list of items defining "Irregular Structures" in high seismic categories is a laundry list of items that cause the structure to be outside of the scope of this code. Then, for most of the defined irregularities there is an exception including technical construction requirements that, when done, allow the structure to not be classified as "Irregular". So, in essence, the current section of "Irregular structures" items are exceptions to the code. Then the exceptions to each item are exceptions to the exception. This makes poor code language.

In addition, many code users are not aware of these requirements because they are located in Chapter 3. As an example, when a code user is looking to the code to determine how to construct cantilever floor joists, they would go to Chapter 5, "Floor Framing". There is a section addressing cantilevers. However, in this section in Chapter 3 it says when a floor cantilevers and supports a wall above (not in the same vertical plane) it is irregular. Then the exception to the exception defines how to construct the floor so that it will not be considered irregular. The BCAC determined that it would be much better to actually include the cantilever construction requirements in the actual section in Chapter 5 that describes cantilevered floor construction.

This proposal does not make any technical changes to the code. It merely moves the construction requirements and limitations therein to the applicable sections that already exist in Chapter 5, Floor framing, Chapter 6, Wall framing and Chapter 8 Roof framing. The limitations are still applicable and by relocating them they will be more noticeable and apparent. The current code already has language and provisions to cover construction that exceeds the limitations of this code.

As shown below, R301.1 states that when, **"… construction is in accordance with the provision of this code…"** it is deemed to comply and the converse is true as well. When construction is NOT in accordance with the provisions it does not comply. Further, Section R301.1.3 it states that, **"…elements exceeding the limits of Section R301 or otherwise not conforming to this code."** shall require an engineered design. With the specific construction requirements now in the applicable code sections, those two provisions already exist and adequately address the cases when mandatory code requirements are exceeded.

> ***R301.1 Application.*** *Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures* ***in accordance with the provisions of this code*** *shall result in a system that provides a complete load path that meets all requirements for the transfer of all loads from their point of origin through the load-resisting elements to the foundation. Buildings and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.*
>
> ***R301.1.3 Engineered design.*** *When a building of otherwise conventional construction contains structural* ***elements exceeding the limits of Section R301 or otherwise not conforming to this code****, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the International Building Code is permitted for all buildings and structures, and parts thereof, included in the scope of this code.*

The existing Section R301.2.2.2 defines limitations for the use and scope of this code for structures in Seismic Design Category C such as weights of materials, stone and masonry veneer, masonry and concrete construction. The existing Section R301.2.2.3 defines further limitations for Seismic Design Category D0, D1 and D2 in addition to the Seismic Design Category C limitations such as height limitations. These two sections remain as is and the current limitations apply.
The net effect is the same and proposal makes the code much more user friendly and will prevent the oversight of the specific construction requirements and limitations that now exist in Chapter 3.

Cost Impact: The code change does not change the existing requirements of the code and will not increase the cost of construction.

RB48-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.2.2.5-RB-BAJNAI-BCAC

RB49 – 13
R301.2.2.2.5, R301.3, R803.2.3

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Revise as follows:

R301.2.2.2.5 Irregular buildings. The seismic provisions of this code shall not be used for irregular structures located in Seismic Design Categories C, D0, D1 and D2. Irregular portions of structures shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. When the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, design of the remainder of the building shall be permitted using the provisions of this code. A building or portion of a building shall be considered to be irregular when one or more of the following conditions occur:

1 through 6 *(No changes to current text)*

7. When stories above *grade* plane partially or completely braced by wood wall framing in accordance with Section R602 or <u>cold-formed</u> steel wall framing in accordance with Section R603 include masonry or concrete construction.

   Exception: Fireplaces, chimneys and masonry veneer as permitted by this code. When this irregularity applies, the entire *story* shall be designed in accordance with accepted engineering practice.

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with story heights not exceeding the following:

1. *(No changes to current text)*
2. For <u>cold-formed</u> steel wall framing, a stud height of 10 feet (3048 mm), plus a height of floor framing not to exceed 16 inches (406 mm).

3 through 5 *(No changes to current text)*

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided story heights are not exceeded. Floor framing height shall be permitted to exceed these limits provided the story height does not exceed 11 feet 7 inches (3531 mm). An engineered design shall be provided for the wall or wall framing members when they exceed the limits of Chapter 6. Where the story height limits of this section are exceeded, the design of the building, or the non-compliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code.

R803.2.3 Installation. Wood structural panel used as roof sheathing shall be installed with joints staggered or not staggered in accordance with Table R602.3(1), or APA E30 for wood roof framing or with Table R804.3 for <u>cold-formed</u> steel roof framing.

Reason: These editorial modifications correct the terminology to reflect what is adopted throughout the IRC and the IBC.

Cost Impact: No impact to the cost of construction is anticipated**.**

RB49-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.2.2.5-RB-MANLEY

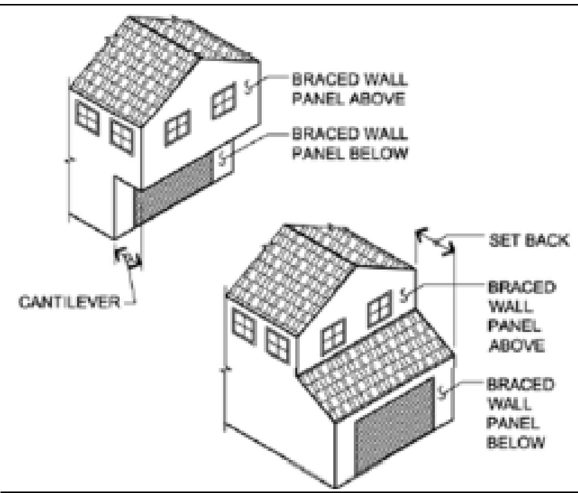
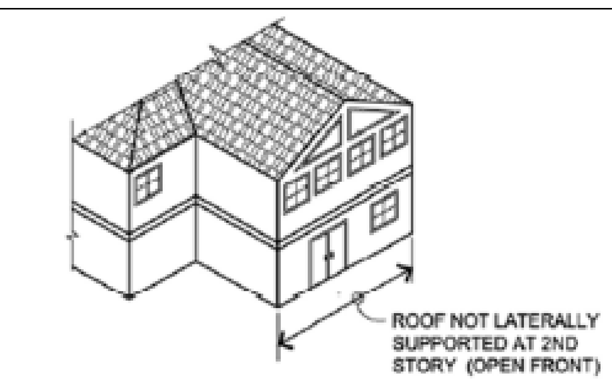
RB50 – 13
R301.2.2.2.5, Table R301.2.2.2.5 (New)

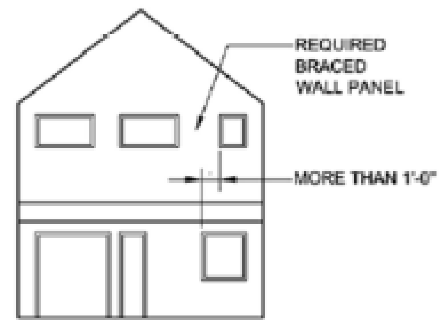
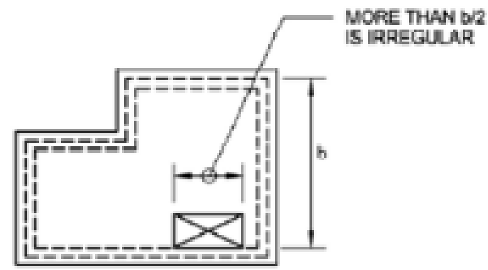
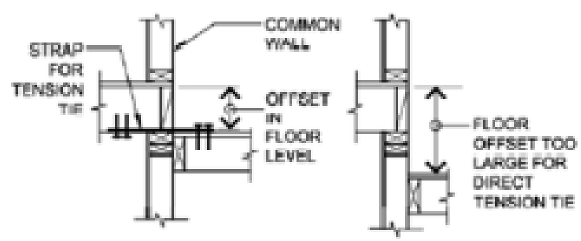
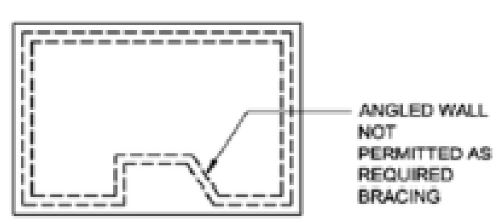
Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, National Council of Structural Engineers Associations; Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

R301.2.2.2.5 Irregular buildings. The seismic provisions of this code shall not be used for irregular structures illustrated in Table R301.2.2.2.5 that are located in seismic Design Categories C, D_o, D_1 and D_2.
in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of AISI S230.

TABLE R301.2.2.2.5
CONFIGURATION IRREGULARITIES

Irregularity Number	Description IRC Section R301.2.2.2.5	Illustration
1	Where exterior shear wall lines or braced wall panels are not in one plane vertically from the foundation to the uppermost story in which they are required.	
2	Where a section of floor or roof is not laterally supported by shear walls or braced wall lines on all edges. Also called an "open front" irregularity.	

<u>**3.**</u>	<u>Where the end of a braced wall panel occurs over an opening in the wall below and ends at a horizontal distance greater than one (1) foot from the edge of the opening. This provision is applicable to shear walls and braced wall panels offset out of plane in accordance with Exception to Item 1 of Section R301.2.2.2.5 of this code.</u>	 EXTERIOR ELEVATION
<u>**4**</u>	<u>Where an opening in a floor or roof exceeds the lesser of 12 feet or 50 percent of the least floor or roof dimension.</u>	 PLAN VIEW
<u>**5**</u>	<u>Where portions of a floor level are vertically offset. Also called “split level” irregularity.</u>	 IRC MAY BE USED ENGINEERED DESIGN REQUIRED
<u>**6**</u>	<u>Where shear walls and braced wall lines do not occur in two perpendicular directions.</u>	 ROOF PLAN

Reason: Exceptions listed under R301.2.2.2.5 “irregular buildings” lacks clarification and requires engineering judgment commonly missing by most non-engineer users. Illustrations on configuration irregularity are added similar to those used in Section 2.3 of FEMA 232, one of the source documents for IRC.

Cost Impact: This code change proposal will not increase construction cost.

RB50-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.2.2.5-RB-MLAKAR-MORE

RB51 – 13
R301.2.4, R322.1

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows:

R301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with Section R322. <u>Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area</u>. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24*.*

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with the provisions contained in this section. <u>Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area.</u> Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

Reason: General requirements for all dwellings in flood hazard area are in R322.1. Then specific requirements are in R322.2 (Zone A) or R322.3 (Zone V), depending on the nature of the flood hazard area. This proposal clarifies that buildings that are located such they are affected by more than one of these areas ("flood zones" on Flood Insurance Rate Maps) must comply with the provisions that take into account flood loads and conditions of the area that requires the more restrictive design. For example, a dwelling that straddles the line that separates Zone A from Zone V must comply with the requirements for Zone V. The IBC has the same phrasing in 1612.1.

Cost Impact: None. It has always been an NFIP requirement that buildings that are in more than one zone have to meet the requirements of the more restrictive zone.

RB51-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.4-RB-QUINN-WILSON

RB52 – 13
R301.2.4.1, R322.1.1

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows

R301.2.4.1 Alternative provisions. As an alternative to the requirements in Section R322, ~~R322.3 for buildings and structures located in whole or in part in coastal high-hazard areas (V Zones) and Coastal A Zones, if delineated,~~ ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R322.1.1 Alternative provisions. As an alternative to the requirements in Section R322, ~~R322.3 for buildings and structures located in whole or in part in coastal high-hazard areas (V Zones) and Coastal A Zones, if delineated,~~ ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

Reason: This code change provides an alternative for buildings and structures in any flood hazard areas to be designed and constructed according to the standard ASCE 24 *Flood Resistant Design and Construction*. There is no reason to limit use of ASCE 24 as an alternative. There are many flood hazard areas where the builder, designer or building official may deem it appropriate to not use prescriptive foundations, such as along riverine waterways and some coastal areas (inland of Zone V) where flood depths are significant and dwellings would need very tall foundations or in riverine floodplains where flood velocities are very fast which suggests it is appropriate to specifically consider hydrodynamic loads.

Another situation where use of ASCE 24 is appropriate is for dwellings in flood hazard areas on alluvial fans. The IBC, by reference to ASCE 24, has specific limitations for buildings on alluvial fans. The fact that the IRC does not have explicit provisions for alluvial fans does not mean code officials should ignore credible information on Flood Insurance Rate Maps or other sources that identifies flood hazard areas subject to high risk conditions, including alluvial fans. Specifying that ASCE 24 is an alternative allows its use where the prescriptive provisions of the IRC may not adequately account for flood risks.

Cost Impact: Use of ASCE 24 is an alternative; there are no cost impacts imposed by providing an alternative.

RB52-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.2.4.1-RB-QUINN-WILSON

RB53 – 13
R301.3

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with story heights not exceeding the following:

1. For wood wall framing, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height shall not exceed that permitted by Table R602.3(5) ~~plus a height of floor framing not to exceed 16 inches (406 mm)~~.

   ~~**Exception:** For wood-framed wall buildings with bracing in accordance with Tables R602.10.3(1) and R602.10.3(3), the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet (3658 mm) without requiring an engineered design for the building wind and seismic force-resisting systems provided that the length of bracing required by Table R602.10.3(1) is increased by multiplying by a factor of 1.10 and the length of bracing required by Table R602.10.3(3) is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of this section.~~

2. For steel wall framing, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the ~~a~~ maximum unsupported bearing wall stud height shall not exceed ~~of~~ 10 feet (3048 mm)~~, plus a height of floor framing not to exceed 16 inches (406 mm)~~.
3. For masonry walls, the maximum *story height* shall not exceed 13 feet 7 inches (4140 mm) and the ~~a~~ maximum bearing wall clear height shall not exceed ~~of~~ 12 feet (3658 mm) ~~plus a height of floor framing not to exceed 16 inches (406 mm)~~.

   Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

4. For insulating concrete form walls, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported ~~bearing~~ wall height per *story* as permitted by Section R611 tables shall not exceed 10 feet (3048 mm) ~~plus a height of floor framing not to exceed 16 inches (406 mm)~~.

5. For structural insulated panel (SIP) walls, the maximum *story height* shall not exceed 11 feet 7 inches (3531 mm) and the maximum bearing wall height per *story* as permitted by Section R613 tables shall not exceed 10 feet (3048 mm) ~~plus a height of floor framing not to exceed 16 inches (406 mm)~~.

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided *story heights* are not exceeded. ~~Floor framing height shall be permitted to exceed these limits provided the *story height* does not exceed 11 feet 7 inches (3531 mm).~~ An engineered design shall be provided for the wall or wall framing members when they exceed the limits of Chapter 6. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the *International Building Code*.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the

BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The purpose of this proposal is to revise the story height limits. Proposal S100-06/07 introduced the 11'-7" story height limit into the IBC and IRC as an alternative to limiting the floor framing height to 16" where wall stud heights were less than 10'-0". In the IBC this change was implemented directly into the equivalent provision under Section 2308 to Item #1 above. In the IRC, the exception was added to the paragraph following the five individual limits. This has led to confusion with Chapter 6 provisions including stud size/height and wall bracing. This revision relocates the story height limit to each of the individual material limits and coordinates it with the material-specific provisions.

The current exception for wood wall studs is deleted as it is redundant with other provisions of Chapter 6 and not necessary. Table R602.3(5) covers when studs in non-bearing walls can exceed 10'-0". Table R602.3.1 provides limited cases when studs in bearing walls can exceed 10'-0". The wall bracing section provides adjustments to wind and seismic bracing amounts for heights up to 12'-0". It is not necessary to repeat that requirement here, in fact that could result in an accidental double-application of the increase factors. Finally, simply applying the wall bracing provisions for walls permitted to be 12'-0" high does not automatically address other structural concerns resulting from an overall increase in story height. This is why only the limited conditions in Table R602.3.1 are allowed for studs greater than 10' in height and supporting floor or roof loads.

Cost Impact: None

RB53-13

Public Hearing:	Committee:	AS	M	D
	Assembly:	ASF	AMF	DF

R301.3-RB-BAJNAI-BCAC

RB54 – 13
R301.3

Proponent: Edward L. Keith, APA, representing The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with story heights not exceeding the following:

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by Table R602.3(5) plus a height of floor framing not to exceed 16 inches (406 mm).

   Exception: For wood-framed wall buildings with bracing in accordance with Tables R602.10.3(1) and R602.10.3(3), the wall stud clear height used to determine the maximum permitted *story height* may be increased to 12 feet (3658 mm) without requiring an engineered design for the building wind and seismic force-resisting systems provided that the length of bracing required is increased in accordance with Tables R602.10.3(2) and R602.10.3(4) for wind and seismic, respectively. ~~by Table R602.10.3(1) is increased by multiplying by a factor of 1.10 and the length of bracing required by Table R602.10.3(3) is increased by multiplying by a factor of 1.20.~~ Wall studs are still subject to the requirements of this section.

2 through 5 *(No changes to current text)*

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided story heights are not exceeded. Floor framing height shall be permitted to exceed these limits provided the story height does not ex-ceed 11 feet 7 inches (3531 mm). An engineered design shall be provided for the wall or wall framing members when they ex-ceed the limits of Chapter 6. Where the story height limits of this section are exceeded, the design of the building, or the non-compliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code.

Reason: The original exception proposed for modification requires an increase in the amount of bracing for wind and/or seismic application when the maximum story height is increased from 10 to 12 feet. The factors given in this original section are duplicated in Tables R602.10.3(2) and R602.10.3(4). As it is written it is unclear that the adjustments must only be applied once. Replacing the requirements in Section R301.2.2.2.1 with a reference to the tables in Chapter 6 would make it clear that the adjustments are to be applied only once and eliminate the potential for "double dipping" along with the unnecessary construction costs.

Cost Impact: This code change proposal will not increase the cost of construction.

RB54-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.1-RB-KEITH

RB55 – 13

R301.4 (New), R301.6 (New), R301.7 (New), R318.1, R505.2, R603.2, R804.2, M1308.1, M2101.6, P2603.2

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Add new text as follows:

R301.4 Additional design loads. In addition to the requirements of Section R301.2, additional design loads for buildings and structures, and all parts thereof, shall be in accordance with this section.

R301.4.1 ~~R301.4~~ Dead load. The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service *equipment*.

R301.4.2 ~~R301.5~~ Live load. The minimum uniformly distributed live load shall be as provided in Table R301.5.

R301.4.3 ~~R301.6~~ Roof load. The roof shall be designed for the live load indicated in Table R301.6 or the snow load indicated in Table R301.2(1), whichever is greater.

R301.5 ~~R301.7~~ Deflection. The allowable deflection of any structural member under the live load listed in Sections R301.4.2~~5~~ and R301.4.3~~6~~ or wind loads determined by Section R301.2.1 shall not exceed the values in Table R301.5~~7~~.

R301.6 Material requirements. The general material requirements set forth in this section shall apply to the use of load-bearing materials in buildings and structures, and all parts thereof.

R301.6.1 Wood framing. Load-bearing wood-wood frame members shall be designed in accordance with Sections R502, R602, R802 and this section.

R301.6.1.1 ~~R301.8~~ Nominal sizes. For the purposes of this code, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

R301.6.2 Cold-formed steel framing. Load-bearing cold-formed steel framing members designed in accordance with Sections R505, R603 or R804 shall be in accordance with this section.

R301.6.2.1 Material. Load-bearing cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of ASTM A 1003, Structural Grades 33 Type H and 50 Type H.

R301.6.2.2 Corrosion protection. Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.

R301.6.2.3 Dimension, thickness and material grade. Load-bearing cold-formed steel framing members shall comply with Figure R301.6.2.3(1) and with the dimensional and thickness requirements specified in Table R301.6.2.3. Additionally, all c-shaped sections shall have a minimum flange width of 1.625 inches (41 mm) and a maximum flange width of 2 inches (51 mm). The minimum lip size for c-shaped sections shall be 0.5 inches (13 mm). Track sections shall comply with Figure R301.6.2.3(2) and shall have a minimum flange width of $1^{1}/_{4}$ inches (32 mm). Minimum Grade 33 ksi steel shall be used wherever 33 mil and 43 mil thicknesses are specified. Minimum Grade 50 ksi steel shall be used wherever 54 and 68 mil thicknesses are specified.

TABLE R301.6.2.3
LOAD-BEARING COLD-FORMED STEEL FRAMING MEMBER SIZES AND THICKNESSES

MEMBER DESIGNATION[a]	WEB DEPTH (inches)	MINIMUM BASE STEEL THICKNESS mil (inches)
350S162-t	3.5	33 (0.0329), 43 (0.0428), 54 (0.0538)
550S162-t	5.5	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)
800S162-t	8	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)
1000S162-t	10	43 (0.0428), 54 (0.0538), 68 (0.0677)
1200S162-t	12	43 (0.0428), 54 (0.0538), 68 (0.0677)

For SI: 1 inch = 25.4 mm

a. The member designation is defined by the first number representing the member depth in hundredths of an inch, the letter "s" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils.

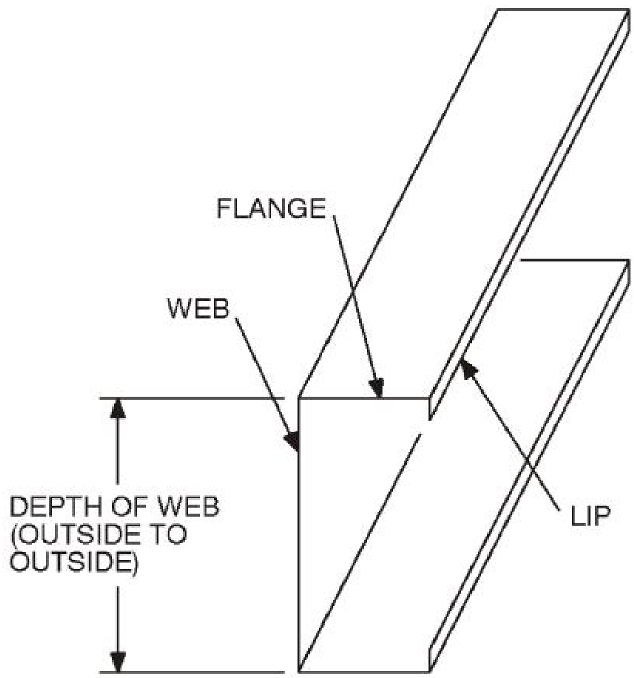


FIGURE R301.6.2.3(1)
C-SHAPED SECTION

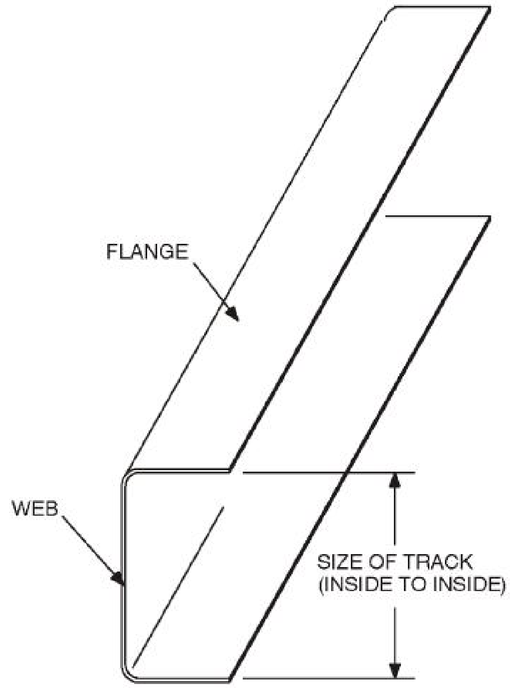


FIGURE R301.6.2.3(2)
TRACK SECTION

R301.6.2.4 Identification. Load-bearing cold-formed steel framing members shall have a legible *label*, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (MPa).

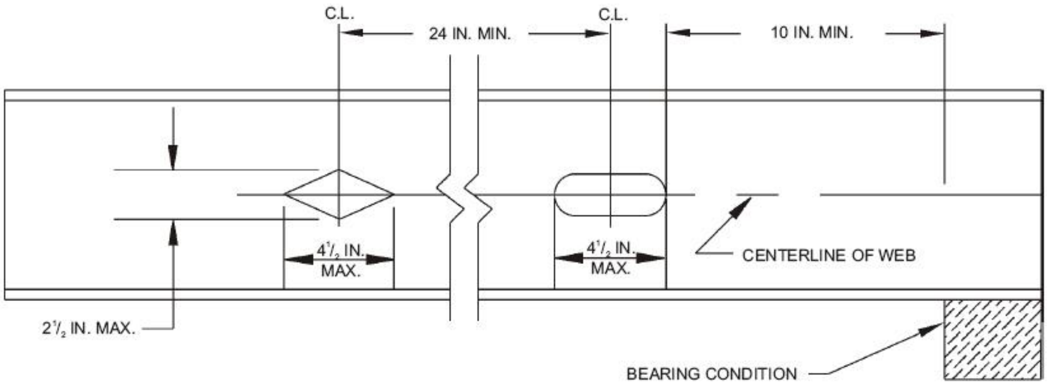
R301.6.2.5 Fastening. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^1/_2$ inch (12.7 mm), shall be self-drilling tapping, and shall conform to ASTM C 1513. Structural sheathing shall be attached to cold-formed steel framing members with minimum No. 8 self-drilling tapping screws that conform to ASTM C 1513. Screws attaching structural-sheathing to cold-formed steel framing members shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^3/_8$ inch (9.5 mm). Gypsum board shall be attached to cold-formed steel framing members with minimum No. 6 screws conforming to ASTM C 954 or ASTM C 1513 with a bugle head style and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel a minimum of three exposed threads. All fasteners shall have a rust inhibitive coating suitable for the installation in which they are being used, or shall be manufactured from material not susceptible to corrosion.

R301.6.2.6 Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing, and web hole patching shall be in accordance with this section.

R301.6.2.6.1 Web holes. Web holes in load-bearing cold-formed steel framing members shall comply with all of the following conditions:

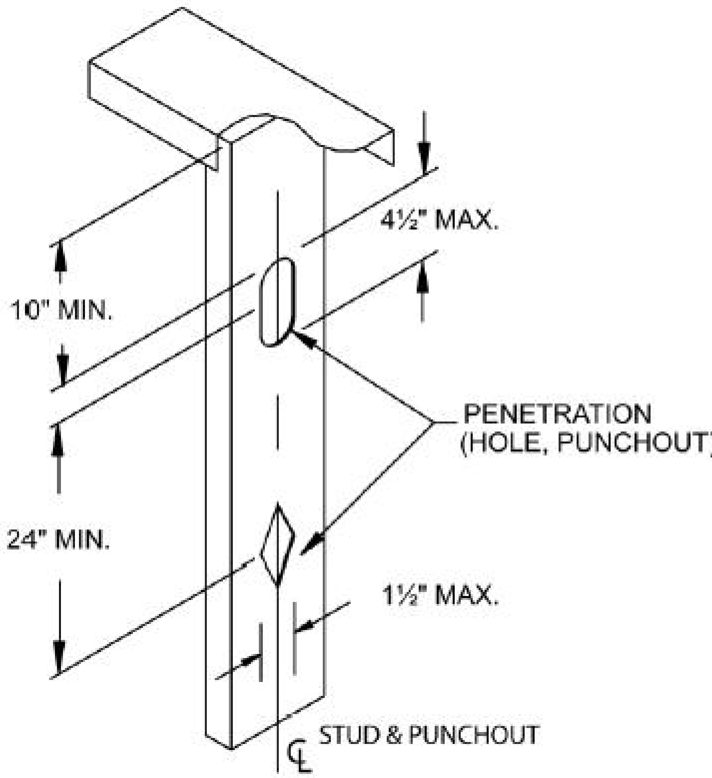
1. Holes shall conform to Figure R301.6.2.6.1(1) for floor and ceiling joists and Figure R301.6.2.6.1(2) for wall studs;
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Holes shall have a center-to-center spacing of not less than 24 inches (610 mm);
4. Holes shall have a web hole width not greater than 0.5 times the member depth, or 1 $^1/_2$ inches(38 mm) for wall studs and 2$^1/_2$ inches (64.5 mm) for floor joists and roof framing members;
5. Holes shall have a web hole length not exceeding 4$^1/_2$ inches (114 mm); and
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section R301.6.2.6.2, patched in accordance with Section R301.6.2.6.3 or designed in accordance with accepted engineering practices.



For SI: 1 inch = 25.4 mm.

FIGURE R301.6.2.6.1(1)
FLOOR AND CEILING JOIST WEB HOLES



For SI: 1 inch = 25.4 mm.

FIGURE R301.6.2.6.1(2)
WALL STUD WEB HOLES

R301.6.2.6.2 Web hole reinforcing. Reinforcement of web holes in floor joists, gable endwall studs, and ceiling joists not conforming to the requirements of Section R301.6.2.6.1 shall be permitted if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shape section with a hole that does not exceed the web hole size limitations of Section R301.6.2.6.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel reinforcing shall be fastened to the web of the receiving member with No. 8 screws spaced not more than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (12.7 mm).

R301.6.2.6.3 Hole patching. Patching of web holes in cold-formed steel framing members not conforming to the requirements in Section R301.6.2.6.1 shall be permitted in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practices where web holes exceed the following size limits:
   1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or
   1.2. The length of the hole measured along the web, exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section R301.6.2.6.3, Item 1, shall be patched with a solid steel plate, stud section, or track section in accordance with Figure R301.6.2.6.3(1) for floor and ceiling joists and Figure R301.6.2.6.3(2) for wall studs. The steel patch shall, as a minimum, be of the same thickness as the receiving member and shall extend at least 1 inch (25 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced no more than 1 inch (25 mm) center-to-center along the edges of the patch with minimum edge distance of $^{1}/_{2}$ inch (13 mm).

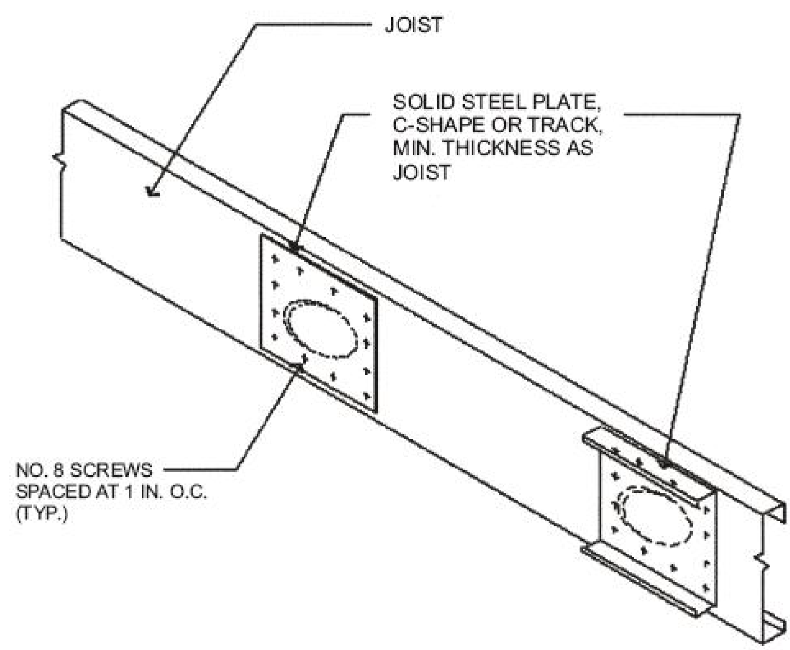
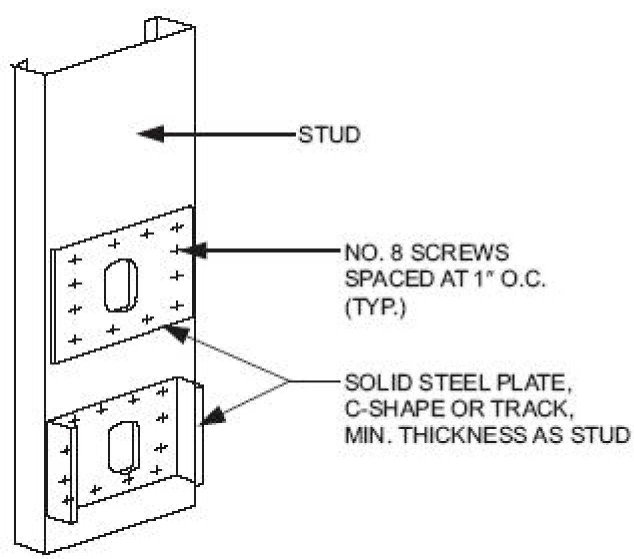


FIGURE R301.6.2.6.3(1)
FLOOR AND CEILING JOIST WEB HOLE PATCH



For SI: 1 inch = 25.4 mm.

FIGURE R301.6.2.6.3(2)
WALL STUD WEB HOLE PATCH

Revise as follows:

R318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table R301.2(1), methods of protection shall be one of the following methods or a combination of these methods:

1. Chemical termiticide treatment, as provided in Section R318.2.
2. Termite baiting system installed and maintained according to the *label*.
3. Pressure-preservative-treated wood in accordance with the provisions of Section R317.1.
4. Naturally durable termite-resistant wood.
5. Physical barriers as provided in Section R318.3 and used in locations as specified in Section R317.1.
6. Cold-formed steel framing in accordance with Section~~s~~ R301.6~~505~~.2.1~~ and R603.2.1~~.

Delete and substitute as follows:

~~**R505.2 Structural framing.** Load-bearing cold-formed steel floor framing members shall comply with Figure R505.2(1) and with the dimensional and minimum thickness requirements specified in Tables R505.2(1) and R505.2(2). Tracks shall comply with Figure R505.2(2) and shall have a minimum flange width of 11/4 inches (32 mm).~~

R505.2 Structural framing. Load-bearing cold formed steel floor framing members shall comply with Section R301.6.2

Delete and substitute as follows:

~~**R603.2 Structural framing.** Load-bearing cold-formed steel wall framing members shall comply with Figure R603.2(1) and with the dimensional and minimum thickness requirements specified in Tables R603.2(1) and R603.2(2). Tracks shall comply with Figure R603.2(2) and shall have a minimum flange width of 11/4 inches (32 mm).~~

R603.2 Structural framing. Load-bearing cold formed steel wall framing members shall comply with Section R301.6.2

Delete and substitute as follows:

~~**R804.2 Structural framing.** Load-bearing, cold-formed steel roof framing members shall comply with Figure R804.2(1) and with the dimensional and minimum thickness requirements specified in Tables R804.2(1) and R804.2(2). Tracks shall comply with Figure R804.2(2) and shall have a minimum flange width of 11/4 inches (32 mm).~~

R804.2 Structural framing. Load-bearing cold formed steel roof framing members shall comply with Section R301.6.2

Revise as follows:

M1308.1 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Section~~s~~ R301.6.2.6~~R505.2.5, R603.2.5 and R804.2.5~~. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Revise as follows:

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Section~~s~~ R301.6.2.6~~R505.2.5, R603.2.5 and R804.2.5~~. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted.

Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.

Revise as follows:

P2603.2 Drilling and notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in Sections R502.8, R602.6, R802.7 and R802.7.1. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Section~~s~~ R301.6.2.6~~R505.2.5, R603.2.5 and R804.2.5~~. In accordance with the provisions in Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Reason: This proposal represents a trial balloon, which was developed in the process of updating and streamlining the cold-formed steel framing (CFSF) provisions of the IRC. Rather than repeat the CFSF material requirements in Sections R505, R603 and R804, it was suggested that the material requirements be stated once in Chapter 3. This proposal incorporates the CFSF provisions in a new Section R301.6 on load-bearing material requirements.

In order for this new section to work as fully intended, it is expected that general requirements for the other load-bearing materials in the IRC would be incorporated into this new section as well. For example, in the case of wood frame construction, that would involve moving and combining requirements from Sections R502.1, R602.1 and R802.1. We believe that this could go a long way towards streamlining the IRC.
Additionally, the section numbering changes recommended for design loads (Section R301.4) is editorial in nature and an attempt to better organize the chapter. It would be ideal to move the wind load and seismic load requirements under this section as well. However, that was deemed too ambitious for this code change without the general consent of the many affected parties.

Please note that the provisions recommended for Section R301.6.2 are not extracted directly from the 2012 IRC; rather, they reflect a generalized version of the language recommended in AISI's separate proposals on Section R505, R603 and R804. If this proposal is successful, it is intended to build on top of those proposals. See their reason statements for additional information on the specific changes to the section from the 2012 IRC.

Cost Impact: No impact to the cost of construction is anticipated.

RB55-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.4-RB-MANLEY

RB56 – 13
R301.5, Table R301.5

Proponent: Stephen Kerr, S.E., Josephson Werdowatz and Associates Inc., representing self (skerr@jwa-se.com)

Revise as follows:

R301.5 Live load. The minimum uniformly distributed and concentrated live loads shall be as provided in Table R301.5.

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
AND MINIMUM CONCENTRATED LIVE LOADS
~~(in pounds per square foot)~~

~~OCCUPANCY OR~~ USE	~~LIVE LOAD~~ UNIFORM (psf)	CONCENTRATED (lbs.)
Uninhabitable attics without storage[b]	10	-
Uninhabitable attics with limited storage[b,g]	20	-
Habitable attics and attics served with fixed stairs	30	-
Balconies (exterior) and decks[e]	40	-
Fire escapes	40	-
Guardrails and handrails[d]	- ~~200[h]~~	200[h]
Guardrail in-fill components[f]	- ~~50[h]~~	50[h]
Passenger vehicle garages[a]	40 ~~50[a]~~	Note a
Rooms other than sleeping room	40	-
Sleeping rooms	30	-
Stairs	40[c]	300[c]

a. Elevated garage floors shall be capable of supporting a 3,000 ~~2,000~~ pound load applied on an area of ~~over a~~ 20 square-inches ~~area~~.

b *(No change to current text)*

c. The minimum concentrated load on stair treads shall be applied on ~~Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over~~ an area of 4 square inches. This load need not be assumed to act concurrently with the uniform load.~~, whichever produces the greater stresses.~~

d through h *(No change to current text)*

Reason: As currently presented, the tile of Table R301.5 states that the loads as uniformly distributed and that the loads are in pounds per square foot. However, this is incorrect, since the guardrail and handrail loads shown are concentrated loads. By splitting the loads into two columns, the Live Load table will accurately represent what type of live load is shown. The passenger vehicle garage loads were also changed to reflect the changes that occurred to the live load in the 2012 IBC.

These changes will make the IRC Live Load table match the format and values of the IBC and ASCE 7 Live Load tables.

Cost Impact: This code change proposal will not increase construction cost.

RB56-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.5-RB-KERR

RB57 – 13
Table R301.5

Proponent: Larry Wainright, Qualtim, representing the Structural Building Components Association (lwainright@qualtim.com)

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

(Portions of table not shown remain unchanged)

a through f *(No change to current text)*

g. Uninhabitable attics with limited storage are those where the maximum clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

1. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches.
2. The slopes of the joists or truss bottom chords are no greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed <u>non-</u>concurrent live load of not less than 10 lb/ft2.

h. *(No change to current text)*

Reason The intent of this proposal is to bring the IRC into agreement with the IBC, Table 1607.1, footnote 'i"; ASCE 7, Table 4-1, footnotes "l" and "m" and the IRC Table R301.5, footnote "b".

The requirement for the 10 PSF live load on those portions of the bottom chords not serving as storage areas was originally intended to reflect the requirement to provide a 10 PSF load per Table R301.5, footnote "b" for uninhabitable attics without storage on those portions of the joist or truss where a storage load is not applied. Footnote b clearly indicates that this is a non-concurrent load (intended for occasional access for maintenance).This is confirmed by the Commentary to the 2012 IBC, Table 1607.1 which states in part, "…Historically, a minimum load of 10 psf (0.48 kN/m2) has been viewed as appropriate where occasional access to the attic is anticipated for maintenance purposes, but significant storage is restricted by physical constraints, such as low clearance or the configuration of truss webs. It provides a minimum degree of structural integrity, allowing for occasional access to an attic space for maintenance purposes. ***Allowing the application of this load to be independent of other live loads is deemed appropriate, since it would be rare for this load and other maximum live loads to occur at once."[emphasis added]***

Current truss design methodology also treats this 10 PSF non-storage load as a non-concurrent live load intended for occasional access for maintenance purposes. Furthermore, the change to this section (S57-09/10) was intended to coordinate the language with the ASCE 7-10 which was in draft form at the time the original proposal was submitted. During the public comment period, ASCE 7 was corrected to show that this is a non-concurrent load but the change was not picked up in the IRC. This code change simply coordinates this footnote with Table 1607.1, Table R301.5 footnote b, ASCE 7, and with the original intent of S57-09/10.

For reference, Table R301.5, footnote "b" states:

b. Uninhabitable attics without storage are those where the maximum clear height between the joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. **This live load need not be assumed to act concurrently with any other live load requirements.**

ASCE 7-10, Table 4-1,footnotes "l" and "m" state:

[l] Uninhabitable attic areas without storage are those where the maximum clear height between the joist and rafter is less than 42 in. (1,067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 in. (1,067 mm) in height by 24 in. (610 mm) in width, or greater, within the plane of the trusses. **This live load need not be assumed to act concurrently with any other live load requirement.**

[m] Uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 in. (1,067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 in. (1,067 mm) in height by 24 in. (610 mm) in width, or greater, within the plane of the trusses. At the trusses, the live load need only be applied to those portions of the bottom chords where both of the following conditions are met:

i. The attic area is accessible from an opening not less than 20 in. (508 mm) in width by 30 in. (762 mm) in length that is located where the clear height in the attic is a minimum of 30 in. (762 mm); and

ii. The slope of the truss bottom chord is no greater than 2 units vertical to 12 units horizontal (9.5% slope).

The remaining portions of the bottom chords shall be designed for a uniformly distributed nonconcurrent live load of not less than 10 Ib/ft2 (0.48 kN/m2).

IBC Table 1607.1, footnote “I” states:

i. Uninhabitable attics without storage are those where the maximum clear height between the joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. **This live load need not be assumed to act concurrently with any other live load requirements.**

Note that the IBC, Table 1607.1 footnote “j” is also inconsistent with ASCE 7, the IRC and the IBC, table 1607.1, footnote “i”.

Cost Impact: This code change will not increase the cost of construction.

RB57-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.5-RB-WAINRIGHT

RB58 – 13
Table R301.5, R311.7.8.1, R317.4, R317.4.1, R507.3

Proponent: Glenn Mathewson, MCP, representing the North American Deck and Railing Association (GlennMathewson@nadra.org)

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

USE	LIVE LOAD
Uninhabitable attics without storage[b]	10
Uninhabitable attics with limited storage[b, g]	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks[e]	40
Fire escapes	40
Guards ~~rails~~ and handrails[d]	200[h]
Guard~~rail~~ in-fill components[f]	50[h]
Passenger vehicle garages[a]	50[a]
Rooms other than sleeping room	40
Sleeping rooms	30
Stairs	40[c]

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. When handrail fittings or bending are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to guard~~rail~~ or used at the start of a flight, the handrail height at the fittings or bending shall be permitted to exceed the maximum height.

R317.4 Wood/plastic composites. Wood/plastic composites used in exterior deck boards, stair treads, handrails and guard~~rail~~ systems shall bear a *label* indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.

R317.4.1 Labeling. Deck boards and stair treads shall bear a label that indicates compliance to ASTM D 7032 and includes the allowable load and maximum allowable span. Handrails and guard~~rail~~ systems or their packaging shall bear a label that indicates compliance to ASTM D 7032 and includes the maximum allowable span.

R507.3 Wood/plastic composites. Wood/plastic composites used in exterior deck boards, stair treads, handrails, and guard~~rail~~ systems shall bear a label indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.

Reason: There is no construction component recognized or required by the IRC called a "guardrail". A "guard" is clearly defined by the IRC in chapter two and does not in anyway require the presence of a "rail". In the decking industry, it is quite common to see guards constructed as outdoor kitchen counters, benches, planter boxes and numerous other architectural elements. Use of the term "guardrail" inappropriately implies that a "rail" must be present in guard assemblies, and has been known to unnecessarily restrict design freedom in the decking industry. Note that footnote "d", associated with the term "guardrail" uses the correct term "guard" within its text. The use of appropriate, IRC-defined terms clarifies the intent of the provisions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB58-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.5T-RB-MATHEWSON

RB59 – 13
Table R301.5

Proponent: Dennis Pitts, American Wood Council, representing American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

(Portions of table not shown remain unchanged.)

a *(No change to current text)*

b. Uninhabitable attics without storage are those where the maximum clear height between joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches high by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.

c through f *(No change to current text)*

g. Uninhabitable attics with limited storage are those where the maximum clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

1. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches.
2. The slopes of the joists or truss bottom chords are no greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed ~~concurrent~~ live load of not less than 10 lb/ft^2. <u>This live load need not be assumed to act concurrently with any other live load requirements.</u>

h *(No change to current text)*

Reason: In ASCE 7-10, uninhabited attics without storage are assigned a 10 psf live load for design of ceiling joists and truss bottom chords. This live load is intended to address occasional access of the space and wording in ASCE 7-10 footnote “l” does not require this live load to be applied concurrently with other live loads when designing the full roof assembly or supporting members such as headers and studs.

Similarly in ASCE 7-10, uninhabited attics with limited storage are also assigned a 10 psf live load in the portions of the attic above ceiling joists and truss bottom chords where significant storage is not possible. As with uninhabited attics without storage, ASCE 7-10 footnote “*m*” does not require the 10 psf live load to be applied concurrently with other live loads when designing the full roof assembly or supporting members such as headers and studs. However, the current wording in the IRC dropped the prefix “non” from “nonconcurrent” when these new provisions from ASCE 7-10 were incorporated. This change returns the wording to the ASCE 7-10 intent.

Cost Impact: No increase in cost of construction.

RB59-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.5T-RB-PITTS

RB60 – 13
Table R301.7

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS [b,c]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors~~/ceilings with plaster or stucco finish~~ <u>(including deck floors)</u>	L/360
<u>Ceilings with brittle finishes (plaster, stucco, etc)</u>	<u>L/360</u>
<u>Ceilings with flexible finishes (gypsum board, etc)</u>	<u>L/240</u>
All other structural members	L/240
Exterior walls—wind loads [a] with plaster or stucco finish	H/360
Exterior walls with other brittle finishes	H/240
Exterior walls with flexible finishes	H/120[d]
Lintels supporting masonry veneer walls [e]	L/600

Note: *L* = span length, *H* = span height.

a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.
b For cantilever members, *L* shall be taken as twice the length of the cantilever.
c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed *L*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *L*/175 for each glass lite or *L*/60 for the entire length of the member, whichever is more stringent. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *L*/120.
d. Deflection for exterior walls with interior gypsum board finish shall be limited to an allowable deflection of *H*/180.
e. Refer to Section R703.7.2.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

This code change was intended to clarify two issues.

1. There is confusion regarding the deflection allowed for deck joists. It was not clear if the original authors intended deck joists to be considered as a floor joist (L/360) or as “other structural members” (L/240). This clarifies the intention.
2. The other significant change addresses the flexibility/stiffness of gypsum board which is a lot more common than either plaster of stucco in most parts of the country. There is now cleaner differentiation between materials and is consistent with the allowable deflection limits in Table R802.4(1) and R802.4(2).

Cost Impact: None.

RB60-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.7T-RB-BAJNAI-BCAC

RB61 – 13
Table R301.7

Proponent: Cole Graveen PE, SE, Raths, Raths & Johnson, Inc., representing self (cwgraveen@rrj.com)

Revise as follows:

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS[b,c]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
All other structural members	L/240
Guards[f,g] Post (horizontal deflection) Top Rail (horizontal deflection) Top Rail (vertical deflection)	 H/12 H/24 + L/96 L/96

(Portions of table not shown remain unchanged)

a through e *(No change to current text)*
f. For the guard post, H shall be taken as the distance from the top of the top rail to the first point of support.
g. For the guard top rail, H shall be taken as the height of the rail and L shall be taken as the distance between edges of the post supports. The deflection of the top rail is measured relative to the center of the two posts.

Reason: Specific deflection limits for guards are proposed to clarify serviceability requirements and to help ensure occupant safety and comfort.

The serviceability requirements for guards in the both the IBC and IRC are vague and open to interpretation. The IBC requires all structural systems and members to have adequate stiffness to limit deflections and lateral drift, Section 1604.3, however it contains no specific deflection limits for guards. The IRC contains a general deflection limit of L/240 in Table R301.7 for all structural members not otherwise listed in the table. However, it is not likely that this limit was originally intended to apply to guards nor does it appear that this limit is commonly applied to guards in design or code enforcement.

The deflection limits proposed in this code change are based upon existing requirements in ASTM E985, *Standard Specification for Permanent Metal Railing Systems and Rails for Buildings*, ASTM D7032, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)*, and ICC-ES AC273, *Acceptance Criteria for Handrails and Guards*. The proposed limits allow reasonable deflection of the guard post and top rail while still ensuring that the guard will perform its intended function of preventing accidental falls. It is important to note that while excessive deflection is undesirable, some deflection is desirable[4] as it can provide warning to the occupant that they are at an edge of an elevated surface and may be unduly loading the guard.

Specific deflection limits are needed not only for clarity, but also to establish acceptable performance. Guards are provided to minimize the possibility of occupants accidentally falling from an elevated surface. The ability of a guard to prevent such an accidental fall depends on its stiffness as well as its height and strength. Guards that meet the strength and height requirements of the code but that move excessively under load could potentially not prevent an accidental fall. Limiting guard deflections to appropriate amounts will help protect occupants against accidentally falling from an elevated surface.

In addition, specific deflection limits are also necessary to help ensure that occupants are comfortable and feel safe. Similar to floor deflection limits that ensure that occupants are not uncomfortable or annoyed with bouncy floors or building drift limits that ensure that occupants are not uncomfortable or sick due to the swaying motion of tall buildings, reasonable lateral deflection limits for guards will help ensure that occupants do not feel that the guard is unsafe.

Example: Under the proposed deflection provisions, the post for a residential guard with a top rail height of 36" above the walking surface and a point of support 3" below the walking surface would have a deflection limit of (36 + 3)/12 = 3.25 inches. The top rail spanning between 4" wide posts that are spaced 4' apart would have a horizontal deflection limit of (48 – 4)/96 + (36 + 3)/24 = 2.10 inches.

References:

1. ASTM E985-00(2006), Standard Specification for Permanent Metal Railing Systems and Rails for Buildings
2. ASTM D7032-08, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)
3. ICC-ES AC273, Acceptance Criteria for Handrails and Guards, Corrected January 2009
4. Loferski, J., Albright, D., and Woeste, F. (July 2007) Tested Guardrail Post Connections for Residential Decks, Structure Magazine

Cost Impact: This code change proposal may increase the cost of construction by increasing the design costs. Designers may have to perform additional serviceability calculations.

RB61-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.7T-RB-GRAVEEN

RB62 – 13
Table R301.7

Proponent: Edward L. Keith, APA, representing The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS [b,c]

STRUCTURAL MEMBERS	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with no finished ceiling attached to rafters	*L*/180
Interior walls and partitions	*H*/180
Floors/ceilings with plaster or stucco finish	*L*/360
All other structural members	*L*/240
Exterior walls – wind loads[a] with plaster or stucco finish	*H*/360
Exterior walls - wind loads[a] with other brittle finishes	*H*/240
Exterior walls - wind loads[a] with flexible finishes	*H*/120[d]
Lintels supporting masonry veneer walls[e]	*L*/600

(Portions of table not shown remain unchanged)

Reason: The proposed changes may be considered editorial. When the current table was put into the 2012 IRC the proposed changes above were inadvertently left out of the table when the changes approved in RB18-09/10 were incorporated.

Cost Impact: The code change proposal will not increase the cost of construction.

RB62-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.7T-RB-KEITH

RB63 – 13
R302.1

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov)

Revise as follows:

SECTION R302
FIRE-RESISTANT CONSTRUCTION

R302.1 Exterior walls. ~~Construction~~ Walls, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2). The minimum fire separation distance shall be measured at right angles from the face of the wall.

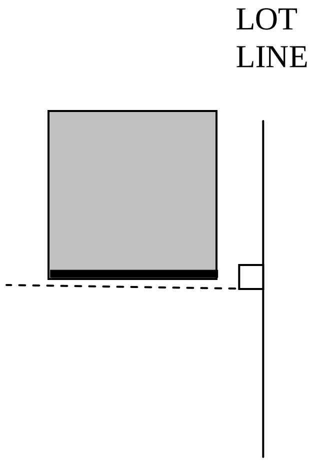
Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *dwellings* and their *accessory structures* located on the same *lot*.

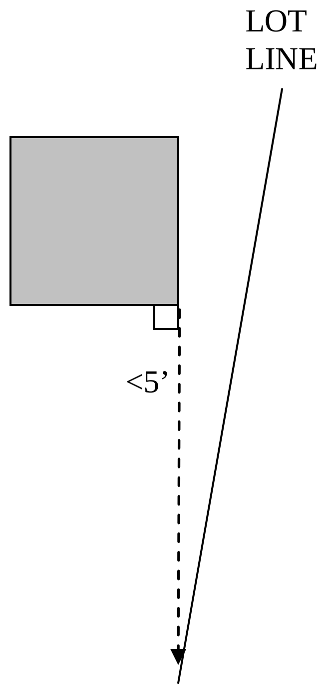
Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

Fire Separation distance is among many of the code requirements that is often misinterpreted or is improperly enforced. To minimize the confusion, the BCAC decided that the best way to clarify how the fire separation distance is measured would be to incorporate language in Section 302.1 that restates the portion of the definition for fire separation distance that explains how it is measured.

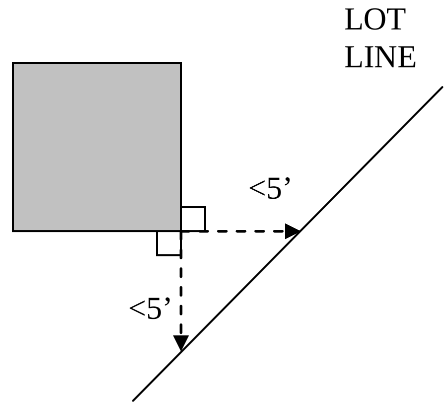
The word “Construction” was deleted to correspond with the term “Wall” used in Tables R302.1(1) and R302.1(2).



Exception #1: the requirement for protecting walls, projections and openings does NOT apply when the walls, projections or opening are perpendicular to the line- no matter how close it is to the lot line.



Conversely Exception #1: the requirements for protecting walls, projections and openings applies to all walls, projections or openings NOT perpendicular to the lot line. To determine the degree that the walls, projections or openings have to be protected, use the *fire separation distance* (as measured perpendicular to the wall)



Fire separation distance is ALWAYS measured perpendicular to the face of the wall.

Cost Impact: None

RB63-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1-RB-BAJNAI-BCAC

RB64 – 13
R302.1

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

<u>Where non-residential buildings are located on the same *lot* containing dwellings and their accessory structures, exterior wall and opening protection and the protection of projections based on fire separation distance shall be determined in accordance with the *International Building Code*.</u>

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *dwellings* and *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

Reason: Section R302.1 of the IRC is not clear as to when an imaginary line shall be used to determine protection due fire separation distance between dwellings and buildings other than dwellings or accessory structures thereto located on the same lot. Furthermore, the IBC in Chapter 5 allows for options other than assuming an imaginary line when determining fire separation distance.

The IBC Section 503.1.2 exempts multiple buildings located on the same lot from exterior fire protection due to fire separation distance when the when considered as portions of one building. Since the IRC does not limit the area of a building and does not require fire sprinkler protection for additions, the equivalent of Section 503.1.2 does not exist in the IRC.

This code change makes a reference to the IBC to make clear that the protection due to fire separation distance shall be determined based on the requirements of the IBC for both a dwelling and the non-residential building that is regulated by the IBC. Without this code change IBC Section 503.1.2 may be construed to not apply. While the IRC has been designed to be a standalone code, the building official will be regulating the non-residential building based on the IBC and this code change provides a clean reference.

Cost Impact: None. This code change will not increase the cost of construction.

RB64-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1 #1-RB-FATTAH

RB65 – 13
R302.1

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fireseparation distance*.
2. Walls of *dwellings* <u>shall not be separated from</u> ~~and~~ *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

Reason: Exception 2 of Section R302.1 of the IRC is not clear and can be read in two different ways. It may be read to exempt only accessory structures other than those discussed in exception 3 and 4 or all dwellings and structures accessory to any of them from the fire separation distance requirements. The IBC Section 503.1.2 exempts multiple buildings located on the same lot from exterior fire protection due to fire separation distance when the when considered as portions of one building. Since the IRC does not limit the area of a building and does not require fire sprinkler protection for additions, the equivalent of Section 503.1.2 does not exist in the IRC.

The National Institutes for Standards and Technology (NIST) has performed full scale fire testing on the fire exposure between buildings of light framed construction and in "NIST Technical Note 1600 - Residential Structure Separation Fire Experiments" (http://www.fire.nist.gov/bfrlpubs/fire08/PDF/f08034.pdf) concludes that "… an adjacent structure can be ignited if flames from a fire inside a house exit through window openings. The experiments illustrated how a fire resistant barrier can, in the scenario tested, slow down flame spread between two structures separated by 1.8 m (6 ft)." The full scale testing demonstrates the benefits of fire separation and the need to limit exterior wall openings and to protect exterior walls.

It is not clear why the IBC and IRC are different with respect to the issue of fire separation. Neither IBC Chapter 6 nor Chapter 7 exempts structures from protections due to fire separation distance, however the IRC through this exception 2 can be construed to exempt a dwelling from being protected relative to an adjacent dwelling owned and operated by a different owner. The definition of fire separation distance in Section R202 includes the use of an imaginary line between buildings, and without this proposed code change the IRC may only require fire separation distance to buildings on the same lot that are not dwellings or accessory structures.

Cost Impact: This code change will have a minimal increase to the cost of construction since land use regulations may restrict the separation between buildings on the same lot due to zoning and other considerations.

RB65-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1 #2-RB-FATTAH

RB66 – 13
R302.1

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1); or dwellings equipped throughout with an automatic sprinkler system installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.
6. <u>Detached patio covers and deck structures located greater than 5 feet from dwellings or lot lines.</u>

Reason: Section R302.1 of the IRC is not clear insofar as detached patio covers and deck structures are concerned and can be read in two different ways. It may be read to exempt the detached accessory structures listed in exception 3 and require that detached patio covers and deck structures comply with fire separation distance requirements. The IBC does not regulate these accessory structures when associated with residential construction and does not exempt them either when associated with non-residential construction.

The IBC Section 503.1.2 exempts multiple buildings located on the same lot from exterior fire protection due to fire separation distance when the when considered as portions of one building. Since the IRC does not limit the area of a building and does not require fire sprinkler protection for additions, the equivalent of Section 503.1.2 does not exist in the IRC.

The National Institutes for Standards and Technology (NIST) has performed full scale fire testing on the fire exposure between buildings of light framed construction and in “NIST Technical Note 1600 - Residential Structure Separation Fire Experiments” (http://www.fire.nist.gov/bfrlpubs/fire08/PDF/f08034.pdf) concludes that “… an adjacent structure can be ignited if flames from a fire inside a house exit through window openings. The experiments illustrated how a fire resistant barrier can, in the scenario tested, slow down flame spread between two structures separated by 1.8 m (6 ft).” The full scale testing demonstrates the benefits of fire separation and the need to limit exterior wall openings and to protect exterior walls.

The proposed code change clarifies that if it is the intent of the IRC not to regulate the fire separation between accessory structures and between accessory structures and dwellings on the same lot that those accessory structures should at least be separated from lot lines as if they were dwellings.

Cost Impact: This code change will have a minimal increase to the cost of construction since land use regulations may restrict the separation between buildings on the same lot due to zoning and other considerations.

RB66-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1 #3-RB-FATTAH

RB67 – 13
Table R302.1(1), Table R302.1(2)

Proponent: C. Ray Allshouse AIA, CBO, City of Shoreline, WA, representing the Washington Association of Building Officials Technical Code Development Committee (rallshouse@shorelinewa.gov)

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *dwellings* and *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	^{3} 5 feet
Projections	Fire-resistance rated	1 hour on the underside[a, b]	^{3} 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	^{3} 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable
a. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave if fire blocking is provided from the wall top plate to the underside of the roof sheathing.
b. Roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave provided no gable vent openings are installed.

TABLE R302.1(2)
EXTERIOR WALLS-DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Fire-resistance rated	1 hour on the underside[b, c]	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable
a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line
b. The roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave if fire blocking is provided from the wall top plate to the underside of the roof sheathing.
c. The roof eave fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave provided gable vent openings are not installed.

Reason: This change is primarily intended to address construction problems associated with having to simultaneously provide fire-resistive eave projections and adequate roof ventilation vents. In addition, current code language is silent on a potential problem of fire-spread to unprotected attics from exterior sources through roof vents where residential structures are built tight to fire separation requirements. Roof ventilation, typically handled by the installation of “bird block” vents under roof eave projections, unfortunately serve as a path for fire spread from adjacent structures. This problem is further aggravated by the fact that NFPA 13D Fire Sprinkler Systems do not require sprinklers in attic spaces. The proposed change provides a builder’s option to mitigate this situation by providing for the installation of a top-side roof vent in lieu of fire-resistance treatment of the eave projection. The resulting solid wood fire-block in place of the otherwise required eave vents protects the attic from fire intrusion. Under this scenario, the unprotected eave is viewed to be expendable and therefore need not be fire rated.

Cost Impact: The code change proposal will not increase the cost of construction.

RB67-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1 (1)T-RB-ALLSHOUSE

RB68 – 13
Table R302.1(1)

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	^{3} 5 feet
Projections	Fire-resistance rated	1 hour on the underside	^{3} 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	^{3} 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< ~~5~~ 3 feet
		None required	~~5~~ 3 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.

Reason: This proposal reduces the penetration protection requirements for non sprinklered buildings to the same level as sprinklered buildings. The code currently allows walls 3 feet from a lot line to have openings up to 25% of the wall area but penetrations are required to be protected. This is senseless. The code overreacts to penetration protection. Foundation vents can be installed without limitation up to a lot line. Walls can have openings up to 25% of the area of the wall at 3 feet from the lot line. But install a penetration for a sill cock at 4 feet and it needs protection! This proposal creates some sense of reason to this section of the code.

Cost Impact: None

RB68-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1(1)T-RB-DAVIDSON

RB69 – 13
Table R302.1(1), R302.1(2)

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	^{3} 5 feet
Projections	Fire-resistance rated	1 hour on the underside	^{3} <u>></u>2 feet to < 5 feet <u>distance to projection</u>
	Not fire-resistance rated	0 hours	^{3} <u>></u>5 feet <u>distance to projection</u>
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.

TABLE R302.1(2)
EXTERIOR WALLS-DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Fire-resistance rated	1 hour on the underside	2 feet[a] distance to projection
	Not fire-resistance rated	0 hours	3 feet distance to projection
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable
a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

Reason: Table R302.1(1) and Table R302.1(2) are not clear when restrictions on projections are concerned. The term fire separation distance is defined in Section R202 clarifies that the fire separation distance is established by measuring “from the building face” to an imaginary line, lot line or the center line of a street. As a result once a fire separation distance is established the exterior wall elements shown in column 1 of both tables are restricted or protected based on their location. Projections however are regulated by the amount that they encroach into the fire separation distance. This code change updates the table for consistency with the TABLE 705.2 of the IBC that limits the distance from the line used to determine fire separation distance to the projection. The IRC and IBC editions preceding the 2012 edition included regulations restricting the length of projections encroaching into the fire separation distance, he famous 1/3 to ½ the fire separation distance approach. This editorial code change proposes to clarify the table and to assist the user.

This code change is being offered in a text format or tabular format in separate code changes to allow the membership a choice in the way that the regulations are adopted into the 2015 IBC.

Cost Impact: None. This code change will not increase the cost of construction.

RB69-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1(1)T-RB-FATTAH

RB70 – 13
Table R302.1(1), Table R302.1(2)

Proponent: Steve Orlowski, representing National Association of Home Builders (NAHB) (sorlowski@nahb.org)

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM ~~FIRE-RESISTANCE RATING~~ Fire Protection	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	≥5 feet
Projections	Fire-resistance rated	~~1 hour~~ 1 layer of 5/8 inch (mm) Type X gypsum board or equivalent [a] on the underside	≥2 feet to < 5 feet
	Not fire-resistance	0 hours	≥5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.
a. Attic and crawlspace ventilation shall be permitted in projections, provided such vents are covered with noncombustible corrosion-resistant mesh with openings not to exceed ¼ inch (6.4mm).

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM ~~FIRE-RESISTANCE RATING~~ FIRE PROTECTION	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Fire-resistance rated	~~1 hour~~ 1 layer of 5/8 inch (mm) Type X gypsum board or equivalent on the underside[b]	2 feet[a]

EXTERIOR WALL ELEMENT		MINIMUM ~~FIRE-RESISTANCE RATING~~ FIRE PROTECTION	MINIMUM FIRE SEPARATION DISTANCE
	Not fire-resistance	rated 0 hours	3 feet
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler systems installed in accordance with Section P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

b. Attic and crawlspace ventilation in projections required to be fire protected shall be covered with noncombustible corrosion-resistant mesh with openings not to exceed ¼ inch (6.4mm).

Reason: After reviewing several UL listed fire-resistant rated assemblies, the NAHB discovered a problem between attempting to provide adequate attic ventilation to certain roof types (hip roofs, cathedral ceilings, etc) and achieving the one-hour fire resistance rating. The UL listed roof assemblies do not allow for any openings in the rated assembly for roofs, thereby creating a problem for proper roof ventilation as required in section R806. The NAHB proposes this code change to balance the needs of both adequate fire protection for exposure fires and proper ventilation of the attic. Under the 2012 IRC, projections are not permitted within two feet of the fire separation distance and the required ventilation opening for attics are minimal, 1/150 of the area of the vented space. The IRC also currently allows 25% of the wall space to be occupied by windows in exterior walls that are within 3'-0" of the fire separation distance. The IRC currently exempt foundation vents from being protected. NAHB suggests that due to the minimal openings required to provide ventilation in the attic, these openings should also be exempted. This proposal suggests removing the current performance requirement of providing a one hour fire-resistant rating on the underside of projections and replacing the language with a prescriptive method which achieves the same performance and allows for minimal openings for ventilation.

Cost Impact: The code change proposal will not increase the cost of construction.

RB70-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R301.1(1)T-RB-ORLOWSKI

RB71 – 13
Table R302.1(1), Table R302.1(2)

Proponent: Steve Thomas, Colorado Code Consulting, LLC representing Colorado Chapter ICC (sthomas@coloradocode.net)

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	N/A	< 2 feet
	Fire-resistance rated	1 hour on the underside	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 5 feet
		None Required	5 feet

TABLE R302.1(2)
EXTERIOR WALLS – DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	3 feet [a]
Projections	Not allowed	N/A	< 2 feet
	Fire-resistance rated	1 hour on the underside	2 feet [a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet [a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None Required	3 feet [a]

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable
a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler systems installed in accordance with Section P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

Reason: There is currently no specific language that states that projections cannot be any closer to a property line than 2 feet. Table 302.1 infers it, but it is not clear. It appears that this requirement was lost when we put the projection requirements into the table format in the 2009 IRC. Our proposal clears up this hole in the code and provides specific language stating that projections are not permitted within 2 feet of the line used to determine the fire separation distance.

Cost Impact: Construction costs will not be affected by this proposal.

RB71-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1(1)T-RB-THOMAS

RB72 – 13
Table R302.1(1)

Proponent: Maureen Traxler, Washington Association of Building Officials Technical Code Development Committee (maureen.traxler@seattle.gov)

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from both sides	< 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Fire-resistance rated	1 hour on the underside	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area <u>per story</u>	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.

Reason: The IRC is ambiguous about how to calculate the percentage of openings allowed in exterior walls. The limitation could be calculated either as a percentage of the area of the entire exterior wall, or as a percentage of each story. This proposal requires that openings in exterior walls be calculated for each story. This method is consistent with IBC Section 705.8.1. Consider this example of the potential consequence of not using the proposed interpretation. If the area of openings was allowed to be calculated based on the entire face of the wall, on a 3-story building the first story of a building 3 feet from a property line could have 75% openings if there were no openings in the other 2 stories.

Cost Impact: None

RB72-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1(1)T-RB-TRAXLER

RB73 – 13
Table R302.1(2), R309.5

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

(Portions of table not shown remain unchanged.)

~~a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler systems installed in accordance with Section P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.~~

~~**R309.5 Fire sprinklers.** Private garages shall be protected by fire sprinklers where the garage wall has been designed based on Table R302.1(2), Footnote a. Sprinklers in garages shall be connected to an automatic sprinkler system that complies with Section P2904. Garage sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a density of 0.05 gpm/ft^2. Garage doors shall not be considered obstructions with respect to sprinkler placement.~~

Reason: It is reasonable to delete this footnote and related section R309.5 because the code doesn't define what a "subdivision" is and there is no way to apply this footnote in a fair manner. Because it only applies to "subdivisions" where ***all*** dwellings are equipped with sprinklers and because there are huge numbers of undeveloped lots scattered throughout existing "subdivisions" in this country because of the financial crises, there is an incentive for lot owners to replat their lots, even single lots, to a separate "subdivision" to take advantage of this exception. It then gives special treatment to a lot owner if there is open space on an adjoining lot by allowing them to construct to a lot line and effectively requiring the adjoining owner to maintain a six foot setback. This effectively limits what that adjoining lot owner can do based on "the neighbor got there first" and can have an impact on the value of the properties.

How do you deny a permit to a homeowner because of something an adjoining owner did? Code philosophy has always been based on the correlation of a building located on its own lot with no credit being given for space on an adjoining lot that is not under the control of the jurisdiction or the owner in question. This code section is so confusing that it will result in a lack of uniformity where ever it is used.

Additionally, as it now stands, this requirement will require record keeping and plan submittals that would not have been necessary previously and require some surveys and site plans to include information on the adjoining lot. For example, if one lot owner exercised this option and placed their building two feet from a lot line, this would require the adjoining owner to maintain a 4 foot setback. Site plans would need to indicate the setback of adjoining lots in order for this to be properly enforced. This will increase the cost of site plan/survey preparation. It also assumes that ready access to adjoining properties will be permitted. This code change is necessary to avoid confusion and treat all property owners equally.

Cost Impact: None

RB73-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1(2)T-RB_DAVIDSON

RB74 – 13
R302.1.1 (New)

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Add new text as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or dwellings equipped throughout with an automatic sprinkler system installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

<u>**R302.1.1 Exterior stairways.** Exterior stairways located above grade shall have a minimum fire separation distance of 5 feet (1524 mm) as measured from the exterior edge of the *stairway*, including landings, to adjacent *lot lines* and from other buildings on the same lot.</u>

<u>**Exception:** Where the *exterior walls* and openings on the adjacent building on the same lot are protected in accordance with Table R302.1(1) based on *fire separation distance.*</u>

Reason: Section R302.1 of the IRC is not clear insofar as exterior stairways located in close proximity to lot lines. The IBC Section 1026.5 requires a fire separation distance of not less than 10 ft since it considers exterior stairways to be exits. The IRC does not fire protection for stairways and as a consequence a dwelling unit located on the second floor served independently with an exterior stairway can be served with a stairway located at a fire separation distance of 0 ft. This lack of protection to a combustible exterior exit element is not prudent as has been demonstrated by full scale fire testing for building exposures.

The National Institutes for Standards and Technology (NIST) has performed full scale fire testing on the fire exposure between buildings of light framed construction and in “NIST Technical Note 1600 - Residential Structure Separation Fire Experiments” (http://www.fire.nist.gov/bfrlpubs/fire08/PDF/f08034.pdf) concludes that “… an adjacent structure can be ignited if flames from a fire inside a house exit through window openings. The experiments illustrated how a fire resistant barrier can, in the scenario tested, slow down flame spread between two structures separated by 1.8 m (6 ft).” The full scale testing demonstrates the benefits of fire separation and the need to limit exterior wall openings and to protect exterior walls and by extension the reason that it is necessary to protect or separate elevated exterior exit ways.

Cost Impact: This code change will have a minimal increase to the code of construction since lad use regulations may restrict the separation between buildings on the same lot due to zoning and other considerations.

RB74-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1.1 (NEW) #1-RB-FATTAH

RB75 – 13
R302.1.1 (New)

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Add new text as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1); or dwellings equipped throughout with an automatic sprinkler system installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

<u>**R302.1.1 Attached and detached accessory structures.** Accessory structures such as patio covers and deck structures, whether attached or detached, shall be located not less than a fire separation distance of 5 ft or more from lot lines.</u>

Reason: Section R302.1 of the IRC is not clear insofar as detached patio covers and deck structures are concerned and can be read in two different ways. It may be read to exempt the detached accessory structures listed in exception 3 and require that detached patio covers and deck structures comply with fire separation distance requirements. The IBC does not regulate these accessory structures when associated with residential construction and does not exempt them either when associated with non-residential construction.

The IBC Section 503.1.2 exempts multiple buildings located on the same lot from exterior fire protection due to fire separation distance when the when considered as portions of one building. Since the IRC does not limit the area of a building and does not require fire sprinkler protection for additions, the equivalent of Section 503.1.2 does not exist in the IRC.

The National Institutes for Standards and Technology (NIST) has performed full scale fire testing on the fire exposure between buildings of light framed construction and in "NIST Technical Note 1600 - Residential Structure Separation Fire Experiments" (http://www.fire.nist.gov/bfrlpubs/fire08/PDF/f08034.pdf) concludes that "… an adjacent structure can be ignited if flames from a fire inside a house exit through window openings. The experiments illustrated how a fire resistant barrier can, in the scenario tested, slow down flame spread between two structures separated by 1.8 m (6 ft)." The full scale testing demonstrates the benefits of fire separation and the need to limit exterior wall openings and to protect exterior walls.

The proposed code change clarifies that if it is the intent of the IRC not to regulate the fire separation between accessory structures and between accessory structures and dwellings on the same lot that those accessory structures should at least be separated from lot lines as if they were dwellings.

Cost Impact: This code change will have a minimal increase to the cost of construction since lad use regulations may restrict the separation between buildings on the same lot due to zoning and other considerations.

RB75-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

(NEW) #2-RB-FATTAH

RB76 – 13
R302.1.1 (New)

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC(afattah@sandiego.gov)

Add new text as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1); or dwellings equipped throughout with an automatic sprinkler system installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

<u>**R302.1.1 Projections.** Projections shall be located a minimum distance from the line used to determine fire separation distance based on Table R302.1(1) and Table R302.1(2). Projections shall be fire resistance rated where required by Table R302.1(1) and Table R302.1(2).</u>

Reason: Table R302.1(1) and Table R302.1(2) are not clear when restrictions on projections are concerned. The term fire separation distance is defined in Section R202 clarifies that the fire separation distance is established by measuring "from the building face" to an imaginary line, lot line or the center line of a street. As a result once a fire separation distance is established the exterior wall elements shown in column 1 of both tables are restricted or protected based on their location. Projections however are regulated by the amount that they encroach into the fire separation distance. This code change updates the table for consistency with the TABLE 705.2 of the IBC that limits the distance from the line used to determine fire separation distance to the projection. The IRC and IBC editions preceding the 2012 edition included regulations restricting the length of projections encroaching into the fire separation distance, he famous 1/3 to ½ the fire separation distance approach. This editorial code change proposes to clarify the table and to assist the user.

This code change is being offered in a text format or tabular format in separate code changes to allow the membership a choice in the way that the regulations are adopted into the 2015 IBC.

Cost Impact: None. This code change will not increase the cost of construction.

RB76-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1.1 (NEW) #3-RB-FATTAH

RB77 – 13
R302.2

Proponent: Matt Archer, Douglas County, CO representing Colorado Chapter Code Change Committee (marcher@douglas.co.us)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **Exception:** A common 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. ~~The wall shall be rated for fire exposure from both sides. and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.~~

Reason: This language is redundant and needs to be deleted because it is already covered in the next section, R302.2.1, Continuity**.**

“The fire-resistance-rated wall or assembly separating *townhouses* shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed *accessory structures*.”

The language about electrical installations is not needed. This section is about fire-resistance-rated construction, not about how to wire a home.

Cost Impact: None

RB77-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2-RB-ARCHER

RB78 – 13
R302.2

Proponent: Michael Gardner, representing Gypsum Association (mgardner@gypsum.org)**;** Jeffrey Hugo, representing National Fire Sprinkler Association (hugo@nfsa.org)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance rated wall assemblies meeting the requirements of Section R302.1 for exterior walls~~.~~

> **Exception:** A common ~~1-hour~~ fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4. <u>The common wall shall be 1-hour-fire-resistance-rated for townhouses complying with Section R313.1 and 2-hour-fire-resistance-rated in all other installations.</u>

Reason: A number of governmental entities, primarily local jurisdictions in states where a state-wide code does not exist, are electing to eliminate the residential sprinkler requirement when adopting a new version of the IRC. In so doing, the jurisdiction runs the risk of overlooking the need to re-insert the language that requires the townhouse separation wall to have a two-hour fire rating if the option to use a common wall is chosen.

This proposal addresses this potential oversight. By reference to Section R313.1, it re-establishes the 2-hour common wall requirement only in the instance where adjacent townhouse units are not sprinklered. If sprinkler systems that meet the requirements of Section R313.1 are installed in adjacent townhouse units, the common wall rating remains 1- hour.

Cost Impact: None

RB78-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2-RB-HUGO-GARDNER

RB79 – 13
R302.2, R302.2.4

Proponent: Jeffrey M. Shapiro, representing IRC Fire Sprinkler Coalition (jeff.shapiro@intlcodeconsultants.com)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

Exceptions:

1. Where a fire sprinkler system in accordance with Section P2904 is provided, a~~A~~ common 1-hour-fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, a common 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses where such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.4 Structural independence. Each individual *townhouse* shall be structurally independent.

Exceptions:

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common ~~1-hour fire resistance-rated~~ wall as provided in Section R302.2, Exceptions 1 or 2.

Reason: The 1-hour separation requirements in these sections were reduced from 2-hour ratings in prior editions of the IRC based on the assumption that fire sprinklers mandated by the IRC would be present in all townhouses. Because some jurisdictions are amending the IRC to remove the fire sprinkler requirement, it is essential that the IRC provide for townhouse separation fire ratings to be returned to 2-hours if sprinklers are not provided. No justification, other than sprinklers, was ever provided for allowing a 1-hour separation, and this reduced rating is inappropriate for non-sprinklered buildings.

Cost Impact: The code change proposal will not increase the cost of construction.

RB79-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2-RB-SHAPIRO

RB80 – 13
R302.2, R302.2.4

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **Exception:** A common ~~1-hour fire-resistance-rated~~ wall assembly <u>with a minimum 1-hour fire-resistance-rating as</u> tested in accordance with ASTM E 119 or UL 263 is permitted for *townhouses* if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common ~~1-hour fire-resistance-rated~~ wall as provided in Section R302.2.

Reason: The present language in R302.2 specifically requires a 1-hour fire resistance rating for common walls between townhouses. It is unclear if the code user could specify and construct a 2-hour or 3-hour fire rated wall assembly if they wanted to though common walls with a higher fire resistance rating should be allowed. This proposal is intended to allow the code user to construct common walls between townhouses with a fire resistance rating of 1-hour or greater.

As a corollary change Exception No. 5 to Section 302.2.4 applies to the common walls between townhouses that have a 1-hour fire resistance rating as specified in R302.2. The exception permits these common walls to be shared by townhouses without having to provide structural independence. However, the wording in the exception also prevents a person who may want to use a common wall with a fire resistance rating that is more than 1-hour from applying the structural independence exemption. This proposal deletes the hourly fire resistance rating from Exception No. 5 so the "common wall" is only required to meet the provisions in accordance with Section R302.2, which includes the requirement for a fire resistance rating of at least 1-hour. The use of the term "common wall" in Exception No. 5 is also consistent with the "common wall" terminology in Exceptions 1, 2 and 4 to Section R302.2.4.

Cost Impact: This proposal will not increase the cost of construction.

RB80-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2 #1-RB-THOMPSON

RB81 – 13
R302.2, R302.2.4, R313.1, R313.2 and R313.3 (New)

Proponent: Jason Thompson, P.E., National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **Exception:** A common 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for *townhouses* <u>with automatic fire sprinkler systems in accordance with Section R313.1</u> if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common ~~1-hour fire-resistance-rated~~ wall as provided in Section R302.2 <u>or Section R313.3</u>.

R313.1 Townhouse automatic fire sprinkler systems. <u>Except as provided in Section R313.3,</u> ~~A~~ <u>a</u>n automatic residential fire sprinkler system shall be installed in *townhouses*.

> **Exception:** An automatic residential fire sprinkler system shall not be required when *additions* or *alterations* are made to existing *townhouses* that do not have an automatic residential fire sprinkler system installed.

R313.1.1 Design and installation. Automatic residential fire sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904.

R313.2 One- and two-family dwellings automatic fire systems. <u>Except as provided in Section R313.3,</u> ~~A~~ <u>a</u>n automatic residential fire sprinkler system shall be installed in one- and two-family *dwellings*.

Exception: An automatic residential fire sprinkler system shall not be required for *additions* or *alterations* to existing buildings that are not already provided with an automatic residential sprinkler system.

R313.2.1 Design and installation. Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.

<u>**R313.3 Automatic fire sprinkler system alternative.** Where an automatic fire sprinkler system is not required to be installed by the adopting authority, the following requirements shall be met.</u>

1. <u>Construction, projections, openings and penetrations of *exterior walls* of *dwellings* shall comply with Table R302.1(1);</u>

2. *Townhouses* constructed with a common wall assembly in accordance with the exception to Section R302.2 shall have a minimum 2-hour fire-resistance-rating. The common wall shall not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations for electrical outlet boxes shall be in accordance with Section R302.4.

Reason: Where adoption of the 2009 and 2012 editions of the International Residential Building Code have been considered, many adopting authorities have made modifications to negate the requirement for mandatory automatic fire sprinkler protection. In some instances the adopting authorities have re-instated the previous requirements for the fire resistance for exterior walls for dwellings and the fire resistance for common walls separating townhouses to those established in the 2006 edition. However, some jurisdictions negated the mandatory automatic fire sprinkler protection but did not require the previous fire resistance requirements for these exterior walls and common walls resulting in reduced fire safety for the occupants and property.

This proposal provides an alternative within the code to permit adopting authorities an option to permit townhouses and one- and two-family dwellings to be unsprinklered provided the fire resistance rating for exterior walls and common walls are established at the code prescribed levels prior to the 2009 IRC.

Cost Impact: This proposal will not increase the cost of construction.

RB81-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2 #2-RB-THOMPSON

RB82 – 13
R302.2, R302.2.4

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **Exception:** A common ~~1-hour fire-resistance-rated~~ wall assembly with a minimum 2-hour fire-resistance-rating as tested in accordance with ASTM E 119 or UL 263 is permitted for *townhouses* if such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.

R302.2.4 Structural independence. Each individual townhouse shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouses separated by a common ~~1-hour fire-resistance-rated~~ wall as provided in Section R302.2.

Reason: Code change RB66-07/08 required townhouses constructed in accordance with the International Residential Code to be provided with automatic sprinkler protection. While this new requirement added a fire safety feature to townhouses the code change also reduced the level of fire safety that existed in the code by reducing the fire resistance rating required for the common wall separating dwelling units in townhouses. The first part of this code change to Section R302.2 will restore the previous IRC code requirement that the common wall separating dwelling units in townhouses shall have a minimum fire resistance rating of 2-hours. There are two reasons for this part of the change.

First, Code Change RB66-07/08 justified the addition of mandatory sprinkler protection for townhouses based on sprinklers being the best tool for providing additional fire safety in residential occupancies. Given that the 2006 IRC already had an established level of fire safety for residential occupancies utilizing townhouse construction with 2-hour fire rated construction for the common wall, the goal for improving fire safety with the addition of sprinkler protection was not fully achieved. The existing level of fire safety was diminished by the reduction in the fire resistance rating of the common wall from 2-hours to 1-hour.

Second, Code Change RB66-07/08 created an inconsistency in the IRC. If two separate one and two family dwellings are constructed on individual lots and each built less than 3 feet from the property line, Section R302.1 and Tables R302.1(1) and R302.1(2) will require the exterior wall of each dwelling to be built with a 1-hour fire resistance rating using a fire exposure from both sides. The net result is that both dwellings are separated from the other adjacent, closely located dwelling by wall construction with a total cumulative fire resistance of 2-hours. Yet, if these same two individual dwellings are physically connected at the property line by a common wall the code permits the fire resistance rating between the townhouse dwelling units to be reduced to 1-hour. The level of fire safety for dwellings with these two configurations is not consistent.

Part 2 of the change modifies Exception No. 5 to Section R302.2.4 by deleting any reference to an hourly fire resistance rating. Presently Exception No. 5 to Section 302.2.4 applies to the common walls between townhouses that have a 1-hour fire resistance rating as specified in R302.2. The exception permits these common walls to be shared by townhouses without having to provide structural independence. However, the wording in the exception also prevents a person who may want to use a common wall with a fire resistance rating that is more than 1-hour from applying the structural independence exemption. This proposal deletes the hourly fire resistance rating from Exception No. 5 so the “common wall” is only required to meet the provisions in accordance with Section R302.2, which includes the requirement for a fire resistance rating. The use of the term “common wall” in Exception No. 5 is also consistent with the “common wall” terminology in Exceptions 1, 2 and 4 to Section R302.2.4.

This code change achieves the full level of fire safety provided for in residential occupancies through the use of sprinkler protection and built-in fire resistant construction. It will also eliminate the fire safety inconsistency in the IRC between dwelling units built with small fire separation distances to property lines and dwelling units constructed as townhouses and connected at property lines by a common wall.

Cost Impact: This proposal will not increase the cost of construction.

RB82-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2 #3-RB-THOMPSON

RB83 – 13
302.2.1

Proponent: C. Ray Allshouse AIA, CBO, City of Shoreline, WA, representing the Washington Association of Building Officials Technical Code Development Committee (rallshouse@shorelinewa.gov)

Revise as follows:

R302.2.1 Continuity. The fire-resistance-rated wall or assembly separating *townhouses* shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed *accessory structures*. <u>Where a *story* extends beyond the *exterior wall* of a *story* below, one of the following shall apply:</u>

1. <u>The fire-resistance-rated wall or assembly shall extend to the outside edge of the upper *story*; or</u>
2. <u>The underside of the exposed floor-ceiling assembly shall be protected as required for projections in Section R302.</u>

Reason: Current townhouse code language is vague regarding the continuity of fire-resistance-rated assemblies, specifically in those instances where an upper story extends beyond the face of the wall immediately below. This represents a potential breach in the integrity of the fire resistance rated construction deemed necessary to ensure full dwelling unit separation in townhouse configured construction. This change clarifies the needed protection requirements. It is not uncommon for local zoning ordinances to include provisions specifically intended to break up continuous building facades as well as the large scale presentation of multifamily buildings. Developers typically utilize offsets between units to achieve these building modulation requirements that frequently result in this configuration. This proposed change provides language to cover this condition thereby helping ensure that the required dwelling separation is achieved.

Cost Impact: The code change proposal will not increase the cost of construction.

RB83-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2.1-RB-ALLSHOUSE

RB84 – 13
R302.1

Proponent: Steve Orlowski, representing National Association of Home Builders (NAHB) (sorlowski@nahb.org)

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *dwellings* and *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation <u>and attic</u> vents installed in compliance with this code are permitted.

Reason: After reviewing several UL listed fire-resistant rated assemblies, the NAHB discovered a problem between attempting to provide adequate attic ventilation to certain roof types (hip roofs, cathedral ceilings, etc) and achieving the one-hour fire resistance rating. The UL listed roof assemblies do not allow for any openings in the rated assembly for roofs, thereby creating a problem for proper roof ventilation as required in section R806. The NAHB proposes this code change to balance the needs of both adequate fire protection for exposure fires and proper ventilation of the attic. Under the 2012 IRC, projections are not permitted within two feet of the fire separation distance and the required ventilation opening for attics are minimal, 1/150 of the area of the vented space. The IRC also currently allows 25% of the wall space to be occupied by windows in exterior walls that are within 3'-0" of the fire separation distance. The IRC currently exempt foundation vents from being protected. NAHB suggest that due to the minimal openings required to provide ventilation in the attic, these openings should also be exempted.

Cost Impact: The code change proposal will not increase the cost of construction.

RB84-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.1-RB-ORLOWSKI

RB85 – 13
R302.2.2, R302.2.3

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Delete without substitution:

~~**R302.2.2 Parapets.** Parapets constructed in accordance with Section R302.2.3 shall be constructed for *townhouses* as an extension of exterior walls or common walls in accordance with the following:~~

1. ~~Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.~~
2. ~~Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.~~

   ~~**Exception:** A parapet is not required in the two cases above when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or *approved* fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of 5/8-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1219 mm) on each side of the wall or walls and there are no openings or penetrations in the roof within 4 feet (1219 mm) of the common walls.~~

3. ~~A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.~~

~~**R302.2.3 Parapet construction.** Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), but in no case shall the height be less than 30 inches (762 mm).~~

Reason: At first one might think of this as a huge leap in eliminating passive fire protection but it isn't. It is recognition of existing rules and the use of residential fire sprinklers. In fact, it is a "tradeoff" if you will.

There are two separate sections of the IRC dealing with buildings adjacent lot lines and the end result is two completely different sets of requirements. Section R302.1 and Table R302.1(1) provide requirements for all buildings regulated under the IRC including dwellings, accessory structures, and townhouses. There are no requirements for parapets for these structures and they apply to dwellings that may be permitted to be constructed to all four lot lines, be of unlimited area, be unlimited in number, and may be constructed side by side for miles.

But, R302.2.2 requires a parapet for a building defined by the building official as a townhouse at the very location where it is not required for any other structure. Townhouses are required to have sprinkler systems. Unlike dwellings, they are required to have open space on at least two sides. It is reasonable for some relaxation of passive fire protection when active fire protection systems are required. It is inconsistent to require parapets for townhouses and not for dwellings. The proposal is to delete the parapet requirements for townhouses to bring the rules in line with those for all other structures regulated in the IRC.

Cost Impact: None

RB85-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2.2-RB-DAVIDSON

RB86 – 13
R302.2.2

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R302.2.2 Parapets. Parapets constructed in accordance with Section R302.2.3 shall be constructed for *townhouses* as an extension of exterior walls or common walls in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

   Exception: A parapet is not required in the two cases above when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or *approved* fire-retardant treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of 5/8-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1219 mm) on each side of the wall or walls ~~and there are no openings or penetrations in the roof within 4 feet (1219 mm) of the exterior or common walls~~.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.

Reason: The language proposed to be deleted was added in last code cycle and it was argued by the proponent that the change put the IRC in sync with the IBC. That is, it was argued that openings were not permitted within a certain distance of a townhouse separation wall in the IBC and the proposal made the IRC consistent with the IBC. This proposal was disapproved by the ICC IRC Committee with the following comment: "**Committee Reason:** This change would impose severe restrictions on penetrations at the roof. This does not mirror the IBC requirement on this issue." The IRC Committee action was right. However the membership approved the code change anyway.

The result is a more restrictive requirement in the IRC than in the IBC for the exact same application. This proposal deletes the conflicting language so that the IRC and IBC rules are again the same.

This proposal is necessary to maintain equivalencies for the same type of structures regulated by the IBC and IRC.
The following language is from the IBC for information only (note the bold italicized text). Note that there is no regulation of openings under method 5.

2012 IBC

705.11 Parapets. Parapets shall be provided on *exterior walls* of buildings.

Exceptions: A parapet need not be provided on an *exterior wall* where any of the following conditions exist:

1. The wall is not required to be fire-resistance rated in accordance with Table 602 because of *fire separation distance*.
2. The building has an area of not more than 1,000 square feet (93 m2) on any floor.
3. Walls that terminate at roofs of not less than 2-hour fire-resistance-rated construction or where the roof, including the deck or slab and supporting construction, is constructed entirely of noncombustible materials.
4. One-hour fire-resistance-rated *exterior walls* that terminate at the underside of the roof sheathing, deck or slab, provided:
   4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.

4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.
4.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire resistance-rated *exterior wall* for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.
4.4. The entire building shall be provided with not less than a Class B roof covering.

5. In Groups R-2 and R-3 where the entire building is provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the underside of the roof sheathing or deck in Type III, IV and V construction, provided:
5.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood for a distance of 4 feet (1220 mm); or
5.2. The roof is protected with 0.625-inch (16 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm).

6. Where the wall is permitted to have at least 25 percent of the *exterior wall* areas containing unprotected openings based on *fire separation distance* as determined in accordance with Section 705.8.

There are no restrictions on openings in the roof under item #5 in the IBC. The IRC should follow suit.

Cost Impact: None

RB86-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.2.2.2-RB-DAVIDSON

RB87 – 13
R302.3, R302.4, R302.7, R302.9, R302.11, R302.12, R310.1, R314.5

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R302.3 Two-family dwellings. *Dwelling units* in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than a 1-hour fire-resistance rating when tested in accordance with ASTME 119 or UL 263. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the *exterior wall*, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

Exceptions:

1. ~~A fire-resistance rating of ½ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.~~ Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313.
2. Wall assemblies need not extend through *attic* spaces when the ceiling is protected by not less than 5/8-inch (15.9 mm) Type X gypsum board and an *attic* draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings*. The structural framing supporting the ceiling shall also be protected by not less than 1/2-inch (12.7 mm) gypsum board or equivalent.

R302.4 Dwelling unit rated penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance rated in accordance with Section R302.2 or R302.3 shall be protected in accordance with this section.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313.

R302.7 Under-stair protection. Enclosed accessible space under stairs shall have walls, under-stair surface and any soffits protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313 and a minimum of one sprinkler head is installed in the enclosed space.

R302.9 Flame spread index and smoke-developed index for wall and ceiling finishes. Flame spread and smoke index for wall and ceiling finishes shall be in accordance with Sections R302.9.1 through R302.9.4.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313.

R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top *story* and the roof space.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313 and a minimum of one sprinkler head is installed in the enclosed space.

Where required, fireblocking shall be provided in wood-frame construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs, as follows:
   1.1. Vertically at the ceiling and floor levels.
   1.2. Horizontally at intervals not exceeding 10 feet (3048 mm).
2. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an *approved* material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E 136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family *dwelling* is required at the line of *dwelling unit* separation.

R302.12 Draftstopping. In combustible construction where there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m2). Draftstopping shall divide the concealed space into approximately equal areas.

Exception: Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313.

Where draftstopping is required and where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

R310.1 Emergency escape and rescue required. *Basements*, habitable attics and every sleeping room shall have at least one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room. Where emergency escape and rescue openings are provided they shall have a sill height of not more 44 inches (1118 mm) measured from the finished floor to the bottom of the clear opening. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with section R310.3. The net clear opening dimensions required by this code shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.

~~**Exception**~~ **Exceptions:**

1. Basements used only to house mechanical equipment and not exceeding total floor area of 200 square feet (18.58 m2).
2. Dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313 shall not be required to comply with this section.

R314.5 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit. Physical interconnection shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

~~Exception~~ Exceptions:

1. Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.
2. Interconnection of smoke alarms shall not be required in dwellings provided with an automatic fire sprinkler system complying with the requirements of Section R313.

Reason: The purpose of this proposal is to provide reductions in code requirements related to fire protection for various components of a dwelling when fire sprinklers are installed, to offset costs created by the installation of fire sprinklers, and to fulfill the scoping provisions to maintain minimum code requirements.

Proponents of residential fire sprinklers have consistently touted the increased safety levels that sprinkler systems bring to new dwellings. That provides the opportunity to eliminate passive systems as unnecessarily redundant and costly. Many similar exceptions are granted buildings in the IBC for sprinkler installation (fire-resistive substitution, reductions in separation requirements, increased travel distance, reduction in exiting requirements, and exclusion of emergency exit windows) so there is ample justification for doing the same in dwellings. While not all of the exceptions granted to buildings constructed under the IBC have an application in residential construction, there are many that do. Similar additional reductions are proposed. Fire sprinkler advocates repeatedly touted the high degree of reliability and effectiveness of residential sprinklers during numerous hearings on sprinkler requirements for dwellings. Based on that testimony, fires will be extinguished when they are small and before they have an opportunity to spread

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E 119 or UL 263 with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Fire-resistance rated	1 hour on the underside	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.

N/A = Not Applicable

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler systems installed in accordance with Section P2904, the fire separation distance for nonrated exterior walls and rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

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and thereby further justifying the proposed tradeoffs.

There is precedent for reductions in code requirements related to fire protection in the IRC already so this is not something new to the IRC. Table R302.1(2) (provided below for information) provides reductions for exterior wall and opening protection for exterior walls required to have a fire protection rating due to proximity to a lot line for sprinklered buildings.

And, IRC Section 501.3 allows the fire resistive membrane for floors to be eliminated in sprinklered buildings.

There are a host of reductions in the IBC. The IBC permits sprinklers to be installed as a substitution for one-hour fire-resistive construction. Table 601 from the IBC is provided for information purposes. See Foot note D.

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior[f, g] Interior	 3 3[a]	 2 2[a]	 1 1	 0 0	 2 1	 2 0	 2 1/HT	 1 1	 0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	$1^1/_2$[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	HT	1[b,c]	0

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

d. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.

e. Not less than the fire-resistance rating required by other sections of this code.

f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

g. Not less than the fire-resistance rating as referenced in Section 704.10

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IBC Section 508.4 requires that separation of occupancy requirements may be reduced by one hour in buildings with sprinkler systems.
Table 803.9 permits the reduction in class of wall and ceiling finishes in sprinklered buildings.
IBC section 907.2.9 allows reductions in fire alarm systems in sprinklered buildings.
IBC Chapter 26 allows reductions in protection of plastics in sprinklered buildings.
IBC section 3004 exempts the venting of elevator hoistways in sprinklered buildings.
IBC Chapters 5 and 10 have literally dozens of reductions in construction and exiting requirements in sprinklered buildings.

It is reasonable to provide the same benefits that come with sprinkler systems to residential occupancies constructed under the IRC as similar occupancies would receive under the IBC.

This proposal eliminates a host of fire related requirements based on superior protection provided by fire sprinklers as stated by fire sprinkler proponents and on equivalencies currently afforded buildings built under the IBC.

Cost Impact: None

RB87-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.3-RB-DAVIDSON

RB88 – 13
R302.4.2

Proponent: Mark Nowak, M Nowak Consulting LLC, representing Steel Framing Alliance

Revise as follows:

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m^2) in area provided the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet $(9.29\ m)^2$ of wall area. The annular space between the wall membrane and the box shall not exceed $^1/_8$ inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
   1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities;
   1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
   1.3. By solid fire blocking in accordance with Section R302.11;
   1.4. By protecting both boxes with listed putty pads; or
   1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any materials provided the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed $^1/_8$ inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
   2.1. By the horizontal distance specified in the listing of the electrical boxes;
   2.2. By solid fireblocking in accordance with Section R302.11;
   2.3. By protecting both boxes with listed putty pads; or
   2.4. By other listed materials and methods.
3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.
4. <u>Ceiling membranes of 1- and 2-hour fire-resistant assemblies are permitted to be interrupted by wall assembly double wood top plates, or steel top tracks complying with Sections 702.3.3 or R603.2.1, where the wall assembly complies with all of the following:</u>
   <u>4.1 The wall assembly is sheathed with Type X gypsum board,</u>
   <u>4.2 All penetrations through the top plate or track are protected in accordance with Section R302.4.1 and</u>
   <u>4.3 The ceiling membrane is installed tight to the top plate or track.</u>

Reason: This proposal is consistent with approved proposal FS76-12 for the 2015 IBC. However, it is inclusive of both wood top plates and steel top tracks. This proposal is needed only for the stacked duplex case in the IRC where the floor may be supported by a wall having at least equivalent fire resistance (R302.3.1) or where non-loadbearing walls are framed prior to installation of the membrane as is often necessary to route mechanical and electrical equipment. Thus, penetrations through the top plate or track are required to be protected per Section R302.4.1 to maintain the integrity and intent of the fire resistance requirement of floors separating stacked duplexes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB88-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.4.2-RB-NOWAK

RB89 – 13
R302.4.3 (New)

Proponent: Larry Wainright, Qualtim, representing the Structural Building Components Association (lwainright@qualtim.com)

Add new text as follows:

R302.4.3 Penetration of fire-resistance rated wall assemblies by structural members. Penetration of wall assemblies required to be fire-resistance rated in accordance with sections R302.2 or R302.3, by roof and floor structural members shall be permitted, provided that the fire-resistance rating, the structural integrity of the wall, and structural independence is maintained.

Reason: The purpose of this code change proposal is to clarify that the fire-resitance rating and the structural integrity of wall assemblies seperating townhouses and two family dwellings needs to be maintained when they are penetrated by other structural members. The most common application is where a floor or roof assembly is supported by the seperation wall. The code is currently silent on this type of penetration while other types of penetrations are addressed in sections R302.4.1 and R302.4.2. This change makes it clear that when supporting these assemblies, some means of maintaining the fire-resistance and integrity of the seperation wall is required.

Cost Impact: This code change will not increase the cost of construction.

RB89-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.4.3 (NEW)-RB-WAINRIGHT

RB90 – 13
R302.5.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1-3/8 inches (35 mm) in thickness, solid or honeycomb core steel doors not less than 1-3/8 inches (35 mm) thick, or 20-minute fire-rated doors~~, equipped with a self-closing device~~.

Reason: The IRC Committee and the ICC membership has consistently opposed closers on the door between a garage and dwelling in the past for a number of legitimate reasons not the least of which is the danger the closers pose to small children.

The effort to require closers on garage doors continued at the national level every year for perhaps fifteen years or more. Each year the membership denied the request because there was no statistical data to support the requirement and there had been no equivalent requirement in several of the legacy codes without an apparent problem.

During the last code cycle, this proposal was approved but again with erroneous and irrelevant arguments. There was no justification for the change and no evidence that a problem exists. Following is the justification from the fire service for the change published in the monograph during the last cycle.

> ***Reason:*** *There are times when proposed code submittals require a very lengthy substantiation, and then there are times when code change proposals just make sense. I would believe this is one of those times where a code change proposal makes a lot of sense. We are seeking a requirement to install items for very minimal costs yet great life saving potentials.*

If it "just makes sense", then there should be a justifiable reason for the requirement. If there is no reason, then it is overregulation. The presumption that the door between the house and garage will be left open is not rational. There is no evidence that the cost is minimal, that the benefit is real, or that any life saving would occur. Closers require maintenance and can easily be defeated by the homeowner. There is no standard specified in the code. It is obvious that there was no thought put into the proposal regarding the practicality, the need, or the ability to enforce. The closing force to engage the lock on a gasketed door can potentially be a hazard to young children who may get knocked over by the door or get fingers pinched in the closing side of the door or the latch side of the door upon closing. The vague language provides little guidance to install or approve these devices which can result in greater liability for the builder. Closers on these doors have not been required in many parts of the country for decades and there is no indication that it has created any hazard to life safety in those regions. This is a non-rated door in a non-rated frame in a non-rated wall.

Furthermore, there is no similar requirement for car ports. In fact, the code requires no protection of the wall between a dwelling and a carport. Windows are permitted. Hollow doors with glazing are permitted. Both structures house the same items including motor vehicles. A carport is enclosed on two or fewer sides. A garage is enclosed on more than two sides but one side can be completely open. And no vehicle door is required in either.

This amendment is necessary because it eliminates a potential for injury to small children, there is no data to support that there is a need for this rule, and it eliminates a source of potential liability for builders.

Cost Impact: None

RB90-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.5.1-RB-DAVIDSON

RB91 – 13
R302.6, Table 302.6

Proponent: Homer Maiel, PE, CBO, 4LEAF, Inc., representing self

Revise as follows:

R302.6 Dwelling/garage <u>and dwelling/carport</u> fire separation. The garage <u>and carport</u> shall be separated as required by Table R302.6. Openings in garage walls shall comply with Section R302.5.

<u>**Exceptions:**</u>

1. This provision does not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.
2. <u>A separation is not required between the dwelling and carport, provided the carport is entirely open on not less than two sides and there are not enclosed areas above.</u>

TABLE R302.6
DWELLING/GARAGE <u>AND DWELLING/ CARPORT</u> SEPARATION

SEPARATION	MATERIAL
From the residence and attics	Not less than $^1/_2$-inch gypsum board or equivalent applied to the garage side
From all habitable rooms above the garage <u>or carport</u>	Not less than $^5/_8$-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than $^1/_2$-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than $^1/_2$-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

Reason: A carport usually poses the same level of hazard to a dwelling unit as a garage does. Currently the code is silent about carport. This revision addresses that deficiency.

Cost Impact: The code change proposal will increase the cost of construction.

RB91-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.6-RB-MAIEL

RB92 – 13
R302.10.1, R302.10.2, R302.10.3

Proponent: Rick Thornberry, P.E., representing Cellulose Insulation Manufacturers Association (CIMA)

Revise as follows:

R302.10.1 Insulation. Insulation materials, including facings~~,~~ such as vapor retarders and vapor-permeable membranes, installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and *attics* shall have a flame spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84 or UL 723.

Exceptions:

1. When such materials are installed in concealed spaces, the flame spread index and smoke-developed index limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. ~~Cellulose~~ Cellulosic fiber loose-fill insulation~~, which is not spray applied,~~ complying with the requirements of Section R302.10.3~~,~~ shall only be required to meet the smoke-developed index of not more than 450.
3. Foam plastic insulation shall comply with Section R316.

R302.10.2 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 or UL 723 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Section R302.10.1 when tested in accordance with CAN/ULC S102.2.

Exception: ~~Cellulose~~ Cellulosic fiber loose-fill insulation shall not be required to be tested in accordance with CAN/ULC S102.2, provided such insulation has a smoke-developed index of not more than 450 and complies with the requirements of ~~Section R302.10.1 and~~ Section R302.10.3.

R302.10.3 ~~Cellulose~~ Cellulosic fiber loose-fill insulation and self-supported spray applied cellulosic insulation. ~~Cellulose~~ Cellulosic fiber loose-fill insulation and self-supported spray applied cellulosic insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly *labeled* in accordance with CPSC 16 CFR, Parts 1209 and 1404.

Reason: The purpose of this code change proposal is to clarify the requirements for cellulose insulation by substituting the industry terms for the two types of cellulose insulation commonly used: cellulosic fiber loose-fill insulation and self-supported spray applied cellulosic insulation. These two terms are taken from ASTM C 739, Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation and ASTM C 1149, Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation, respectively. The application of the Exception to Section R302.10.2 is also simplified and made more user friendly by including the smoke-developed index requirement and deleting the reference to Section R302.10.1 where that requirement is specified by the Exceptions to those sections. This saves the code user a step in the process of applying Section R302.10.2 and avoids potential misapplications and misinterpretations that often occur when dealing with multiple Exceptions.

Cost Impact: This code change proposal will not increase the cost of construction.

RB92-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.10-RB-THORNBERRY

RB93 – 13
R302.11.1

Proponent: Tony Crimi, A.C. Consulting Solutions, Inc., representing North American Insulation Manufacturer's Association (NAIMA) (tcrimi@sympatico.ca)

Revise as follows:

R302.11.1 Fireblocking materials. Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25.4 mm) nominal lumber with broken lap joints.
3. One thickness of 23/32-inch (18.3 mm) wood structural panels with joints backed by 23/32-inch (18.3
   mm) wood structural panels.
4. One thickness of 3/4-inch (19.1 mm) particleboard with joints backed by 3/4-inch (19.1 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-quarter-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other *approved* materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested <u>in accordance with ASTM E 119 or UL 263,</u> for the specific application.

Reason: This proposal clarifies the code requirement and prevents potentially unintended test methods from being used for these purposes. The proposal aims to provide more detail to the requirement to test cellulose insulation in accordance with the appropriate fire test standards. During the last cycle, FS118-09/10 added spray-applied cellulose to the list of acceptable fireblocking materials. The proponent's statement does identify ASTM E119 as the test standard used by the Cellulose Insulation Manufacturers Association (CIMA) to conduct a variety of fireblocking fire tests.

Cost Impact: This code change proposal will not increase the cost of construction.

RB93-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.11.1-RB-CRIMI.doc

RB94 – 13
R 302.12, R302.12.2 (New)

Proponent: Sean DeCrane, Battalion Chief, representing Cleveland Division of Fire, International Association of Fire Fighters (rovloc93@aol.com)

Revise as follows:

R302.12 Draftstopping. Draftstopping shall be provided in construction in accordance with this section.

R302.12.1 Concealed spaces. In combustible construction where there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m2). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

R302.12.2. Attics. Draftstopping shall be provided in attics with an area that exceeds 1,500 square feet (92.9 m^2). The draftstopping shall be installed such that each draftstopped area of the attic does not exceed 1,500 square feet (92.9 m^2).

Reason: Void spaces, are areas of potentially large fire growth that can have explosive results for responding and operating fire fighters. We have seen multiple incidents where large single-family residences can simulate commercial size fires due to the large open areas. Modern construction techniques are providing home owners with a number of options including large open spaces. These large floor plans lead to increased amounts of void spaces in the attic and floor systems. When fire travels into these attic spaces, they are fuel enriched by the combustible wood truss and in many instances the sprayed insulation.
With large amounts of oxygen the fire can grow unchecked and on many occasions showing very little evidence on the exterior of amount of fire present. One side discovery of the original Underwriters Laboratories studies on lightweight construction in 2006, was the performance of the plastic ridge vent which when subjected to elevated temperatures would melt and create a seal at the peak of the ridge causing the increased pressures from the fires to push downward on top of operating fire fighters.
We have seen instances where fire fighters have been killed or injured. In 2010 Fire Fighter Kyle Wilson, of Price William County, was killed while performing Search and Rescue operations from a wind driven exterior fire that accumulated in the attic space until it exploded downward trapping Fire Fighter Wilson in the Master Bedroom causing him to burn to death.
In 2012 in Huntington, MD, ten fire fighters were injured, two seriously, when they were investigating the smell of smoke on the second floor. The fire originated in the chimney and travelled into the attic space where it had plenty of air to grow uncontrolled until the building pressure caused the fire to explosively escape from the attic downward on the fire fighters. Fire fighters were forced to dive down the stairwell and out the second story windows causing one fire fighter to break his back.
The author will acknowledge the lack of technical justification at the time of submission. There is current testing being conducted at Underwriters Laboratories and NIST and we hope to have additional test data available at the code hearing in Dallas.

Cost Impact: This proposal will increase the cost of construction

RB94-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.12-RB-DECRANE

RB95 – 13
R302.12

Proponent: Wesley Walters, Clark County Nevada Development Services, representing self

Revise as follows:

R502.12 Draftstopping. In combustible construction where there is ~~usable~~ occupied space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m2). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

Reason: Usable is an undefined term within the code. The term occupied is defined and describes the whole area of the house.

Cost Impact: The code change proposal will not increase the cost of construction.

RB95-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.12-RB-WALTERS

RB96 – 13

R302.13 (New), Table N1102.4.1.1 (R402.4.1.1)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IRC COMMITTEE. PART II WILL BE HEARD BY THE IECC COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Duncan Prahl, IBACOS Inc, representing self (dprahl@ibacos.com)

PART I - IRC-RB

Add new Text as follows:

R302.13 Sealants. In combustible construction, sealants that are used to limit air leakage in accordance with Section N1102.4 and Table N1102.4.1.1 shall not be required to comply with ASTM E 136 and shall not be required to be included in the fire tests required in association with the following:
1. Fire resistant assemblies where required by Sections R302.1, R302.2, R302.4, and R302.6;
2. Fireblocking where required by Section R302.11 and
3. Draftstopping where required by Section R302.12.
(Existing Section R302.13 to be renumbered.)

PART II - IECC-RE

Revise as follows:

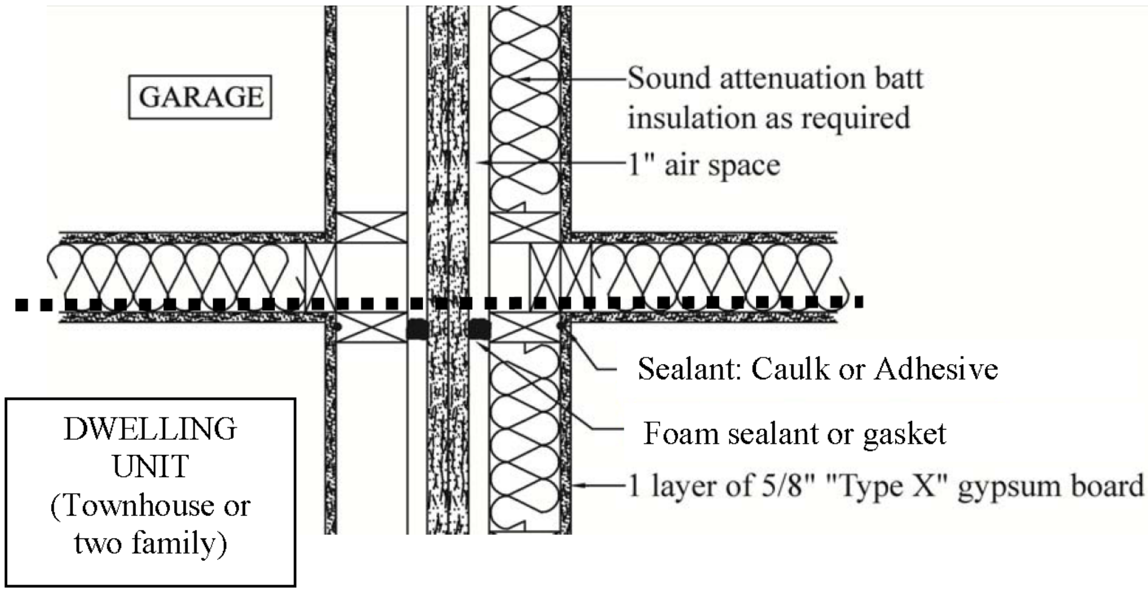
TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

Fire separation assemblies in accordance with *International Residential Code* Sections R302.1, R302.2, R302.4, and R302.6, and fireblocking and draftstopping in accordance with *International Residential Code* Sections R302.11 and R302.12, respectively.	Air sealing shall be provided in all fire separation assemblies where the assembly, fireblocking or draftstopping is part of or intersects the thermal enclosure.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces

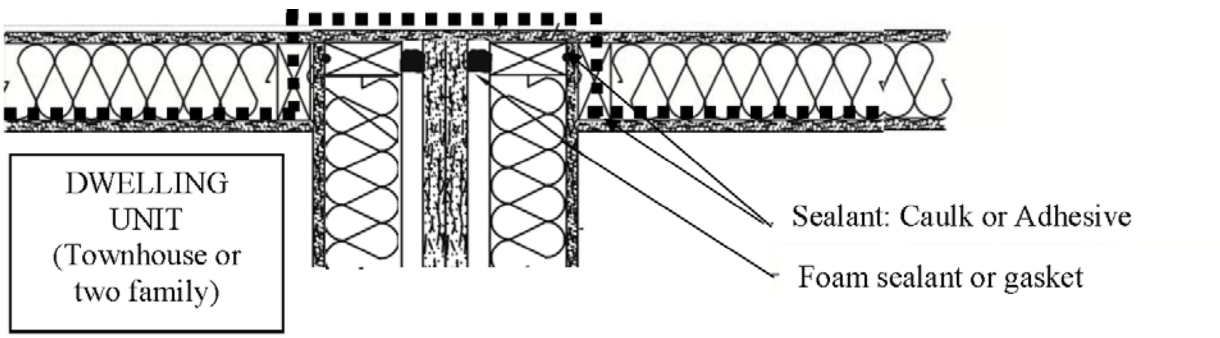
(Portions of table not shown to remain unchanged)

Reason: Many ASTM E119 tested assemblies do not include any sealant materials for airtightness at the location where the assembly intersects the thermal enclosure of the building in the real world. Builders and code officials should be guided specifically on the airsealing that should be included at these locations. The materials used for sealing this location fall under the same criteria as sealants that the committee approved in for sealants used to fireblock annular spaces per R302.11. Many common sealants have an auto ignition temperature that is the same as or higher than the wood framing within the assembly and, as such, would only burn if the wood in the assembly was already on fire.

Examples of locations that are indicative of the need for sealants within fire separation assemblies follow. The heavy dotted line indicated the desired location of the airtightness layer within the constructed assembly as it appears in some typical details:



Two hour separation, plan view at garage



Two hour separation, plan view at exterior wall

Cost Impact:
The code change proposal will not increase the cost of construction

RB96-13
PART I - IRC-RB

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II - IECC-RE

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R302.13 (NEW)-RB-PRAHL

RB97 – 13
R303.1, R303.4, M1507.1

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IRC-RB COMMITTEE. PART II WILL BE HEARD BY THE IRC-PM COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Joe Lstiburek, Building Science Corporation; Mike Moore, P.E., Newport Ventures, representing Broan-NuTone (mmoore@newportpartnersllc.com); Thomas D. Culp, Birch Point Consulting, representing the Glazing Industry Code Committee

PART I-IRC-RB

Revise as follows:

R303.1 Habitable rooms. All habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural *ventilation* shall be through windows, doors, louvers or other *approved* openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

~~1. The glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical *ventilation* system is installed in accordance with Section M1507.~~

~~2~~1. The glazed areas need not be installed in habitable rooms without exterior walls, where an opening is not required by Section R310, mechanical ventilation is installed in accordance with Section M1507, and ~~Exception 1 above is satisfied and~~ artificial light is provided capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

~~3~~2. Use of sunroom and patio covers, as defined in Section R202, shall be permitted for natural *ventilation* if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening.

PART II-IRC-RM

Revise as follows:

R303.4 Mechanical ventilation. ~~Where the air infiltration rate of a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the d~~Dwelling units shall be provided with local exhaust and whole-house mechanical ventilation in accordance with Section M1507~~.3~~.

M1507.1 General. ~~Where l~~Local exhaust ~~or~~ and whole-house mechanical ventilation ~~is provided, the equipment~~ systems shall be designed and installed in accordance with this section.

Reason: Experience from decades of work with builders confirms that achieving a home air tightness of around 3 to 5 ACH 50 is not difficult if the builder just addresses the "big holes" during construction.[1] The practice of addressing big holes was initially tackled by builders to reduce call backs associated with comfort complaints from homebuyers. Once builders figured out that plugging the big holes reduced callbacks, the practice went mainstream. In 2009, the steps required to plug the big holes were codified in the mandatory air barrier table (IRC Table N1102.4.2; IECC Table R402.4.1.1). At the end of 2012, 55% of the states had adopted the 2009 IECC or more stringent. Fast forward to 2015, and 76% of states (which accounted for 86% of the single family starts in 2011) are expected to have adopted the 2009 IECC or more stringent.[2]

This timeline shows that building tight (3 to 5 ACH 50) has become the new standard, regardless of whether or not a builder confirms the tightness with a blower door test. Of course, the one potential problem with building tight is the negative impact it can have on indoor air quality if mechanical ventilation is not provided; and there is broad consensus that air quality begins to be compromised at or below 5 ACH 50 if mechanical ventilation is not provided. Without mechanical ventilation, tight homes can experience elevated humidity levels; increased condensation potential on windows; higher concentrations of dust mites and allergens; and higher concentrations of pollutants such as chloroform, formaldehyde, acetaldehyde, and other VOCs that have negative health impacts.

With today's typical, code-minimum construction resulting in homes that easily achieve 3 to 5 ACH 50, a blower door test is not needed to confirm that these homes are less than 5 ACH 50 and in need of mechanical ventilation. At this point, mechanical ventilation is needed to provide minimum acceptable air quality for code-minimum construction. This change will ensure that the comfortable, energy efficient homes that builders are now building are also provided with minimum indoor air quality.

At the same time, we do not want to discourage the use of operable windows, which offer natural ventilation in addition to daylight and egress. Even with mechanical ventilation, a home occupant needs to be able to control their own environment, particularly in the case of an emergency such as a power failure (e.g. being able to open windows for airflow in the aftermath of a storm or blackout). As such, this proposal deletes exception 1 and modifies exception 2 of R303.1 to ensure operable windows in habitable rooms are still installed even with mechanical ventilation, only keeping the exception for interior rooms with no exterior walls. Note that the IRC still permits bathrooms and water closets to use local exhaust instead of windows, as per the exception to R303.3.

References:

1. J.W. Lstiburek, "Just Right and Airtight" ASHRAE Journal, May 2011.
2. U.S. DOE Building Energy Codes Program, "Status of State Energy Code Adoption, Residential: Projected" accessed from http://www.energycodes.gov/adoption/states on Nov 29, 2012.

Cost Impact: Because new standard construction practices will typically result in building envelope tightness levels of 3 to 5 ACH 50, these dwellings should already be provided with mechanical ventilation (based on R303.4). So, no additional costs should be incurred for mechanical ventilation systems. Also, removing the loophole of trading off windows for mechanical ventilation in habitable rooms is not expected to affect the practice of the overwhelming majority of builders who tend towards more windows, versus less, based on consumer demand.

RB97-13
PART I

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.1-RB-CULP-LSTIBUREK-MOORE

RB98 – 13
R303.1

Proponent: Jeff Inks, representing the Window & Door Manufacturers Association.

Revise as follows:

R303.1 Habitable rooms. All habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural *ventilation* shall be through windows, <u>skylights,</u> doors, louvers or other *approved* openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical *ventilation* system is installed in accordance with Section M1507.
2. The glazed areas need not be installed in rooms where Exception 1 above is satisfied and artificial light is provided capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.
3. Use of sunroom and patio covers, as defined in Section R202, shall be permitted for natural *ventilation* if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening.

Reason: Openable skylights are intended to provide natural ventilation and should also be expressly included with other fenestration approved for meeting this requirement.

Cost Impact: This code change will not increase the cost of construction.

RB98-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.1 #1-RB-INKS

RB99 – 13
R303.1

Proponent: Jeff Inks, representing the Window & Door Manufacturers Association.

Revise as follows:

R303.1 Habitable rooms. All habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural *ventilation* shall be through windows, doors, louvers or other *approved* openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

~~1. The glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical *ventilation* system is installed in accordance with Section M1507.~~

~~2~~1. The glazed areas need not be installed in rooms ~~where Exception 1 above is satisfied and~~ without *exterior walls* where all of the following conditions are met:
   1.1 An opening is not required by Section R310.
   1.2 A~~a~~rtificial light is provided capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.
   1.3 A whole-house mechanical *ventilation* system is installed in accordance with Section M1507.

~~3~~2. Use of sunroom and patio covers, as defined in Section R202, shall be permitted for natural *ventilation* if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening.

Reason: While whole-house mechanical ventilation systems can provide adequate ventilation when in operation, natural ventilation should still be provided as an option and more importantly, needs to be provided as a back-up in the event of power outages, especially when power outages can be prolonged for many hours or many days, or for problems that may occur with the ventilation system, or for in-home events such as cooking or burning food when supplemental natural ventilation may be needed or desired. Therefore, a blanket exception should not be provided.

The amendment to Exception 2 is proposed to maintain an exception for providing glazed areas in rooms (such as certain basement rooms) with no *exterior walls* as defined by the IRC provided they meet all of the same conditions required by the current provisions in order for the exception to R303.1 to apply.

Cost Impact: This code change may increase the cost of construction in some cases where fixed glazing may have been used in lieu of openable glazing and then depending on the glazing options being considered.

RB99-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.1 #4-RB-INKS

RB100 – 13
R303.4

Proponent: Mike Moore, P.E., Newport Ventures, representing Broan-NuTone (mmoore@newportpartnersllc.com), Jeremiah Williams representing U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Revise as follows:

R303.4 Mechanical ventilation. Where the air infiltration rate of a dwelling unit is ~~less than~~ 5 air changes per hour <u>or less</u> when tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the dwelling unit shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3.

Reason (Moore): The current language is inconsistent with N1103.5, which requires mechanical ventilation for all dwellings, and also requires dwellings in climate zone 1 and 2 to have an air tightness “not exceeding” 5 ACH 50. By changing this language to 5 ACH or less, “the two sections are brought closer into alignment.

Reason (Williams) : Chapter R4 of the International Energy Conservation Code and Chapter 11 of the IRC require air leakage to be equal or less than 5 air changes per hour in climate zones 1 and 2, with lower rates required in other climate zones. This minor code change creates consistency where all buildings constructed to the air tightness levels of the IECC and IRC must have whole house mechanical ventilation systems.

Cost Impact (Moore): There is no additional cost, as mechanical ventilation is already required for these dwellings based on section N1103.5.

Cost Impact (Williams): The code change proposal will increase the cost of construction only if tested air leakage in climate zones 1 and 2 is exactly 5 air changes per hour.

RB100-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.4-RB-MOORE

RB101 – 13
R303.5.1

Proponent: David Hall, CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Revise text as follows:

R303.5.1 Intake openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks~~, except as otherwise specified in this code~~. ~~Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, such opening shall be located a minimum of 3 feet (914 mm) below the contaminant source~~.

For the purpose of this section, the exhaust from *dwelling* unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

<u>**Exceptions:**</u>

1. <u>The 10 foot (3048 mm) separation is not required where the intake opening is located 3 feet (914 mm) or greater below the contaminant source.</u>
2. <u>Separation distances for appliance vents shall be as allowed in Chapters 18 and 24.</u>

Reason: This proposal is text cleanup**.** The phrase "except as otherwise specified in this code" is not user-friendly since it offers no guidance as to where something else is specified. The new exception # 2 provides the exact text for what is otherwise specified. New exception # 1 is just the original last sentence of this section reworded into an exception format, because it is actually an exception to the 10 foot rule.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB101-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.5.1-RB-HALL-PMGCAC

RB102 – 13
R303.7, R303.7 (New), R303.7.1, R303.8 (New)

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

~~**R303.7 Stairway illumination.** All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. For interior stairs the artificial light sources shall be capable of illuminating treads and landings to levels not less than 1 footcandle (11 lux) measured at the center of treads and landings. Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a *basement* from the outside *grade* level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway.~~

> ~~**Exception:** An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each stairway section.~~

~~**R303.7.1 Light activation.** Where lighting outlets are installed in interior stairways, there shall be a wall switch at each floor level to control the lighting outlet where the stairway has six or more risers. The illumination of exterior stairways shall be controlled from inside the *dwelling* unit.~~

> ~~**Exception:** Lights that are continuously illuminated or automatically controlled.~~

R303.7 Interior stairway illumination. Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. The light source shall be capable of illuminating treads and landings to levels of not less than 1 foot-candle (11 lux) as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.

> **Exception:** A switch is not required where remote, central, or automatic control of lighting is provided.

R303.8 Exterior door illumination. At least one wall-switch-controlled lighting outlet shall be installed to provide illumination on the exterior side of each exterior door having grade level access, including exterior stairways providing access to a basement.

> **Exception:** A switch is not required where remote, central, or automatic control of lighting is provided.

(Renumber subsequent sections)

Reason: This section is proposed for revision for one reason – it is confusing. The first sentence says that all interior and exterior stairways, including treads and landings, shall be illuminated. The next two sentences state that interior stairs must have lights near the landings and provide a minimum of 1 foot-candle of light. Then the next sentence states that exterior stairs must be provided with a light source in the immediate vicinity of the top landing but seems to exclude treads and landings. So, going back to the first sentence, the code says exterior stairs need landings and tread illuminated. Now just the top landing is illuminated for exterior stairs. Which one is it? The reference to 1 foot-candle of light is only applicable to interior stairs. It seems there is no standard for exterior stairs. But some code officials apply the 1 foot-candle standard to exterior stairs and others do not. Some code officials require exterior stairs to be illuminated along their entire length. Others only require light at the top landing. Then there is the exception that appears to apply only to interior stairs but can be misconstrued to support the contention that exterior stairs must be lit for their entire length.

Furthermore, the code requires the light source be in specific locations and meet certain intensities. If the intensity is met, what difference does it make where the light source is? The text referencing the location of the light source for interior stairs is proposed for deletion since the interest is in the amount of light on the walking surface, not on the light location.

The electrical code will require a switched light at exterior doors but that may not illuminate exterior stairs. This proposal would not waive any requirement found in the electrical code but there seems to be a conflict between what could be argued is the intent of R303.7, which is to illuminate exterior stairs, and the electrical code which only requires illumination of the exterior side of exterior doors having access to grade.

E3903.3 Additional locations. *At least one wall-switch-controlled lighting outlet shall be installed in hallways, stairways, attached garages, and detached garages with electric power.* ***At least one wall-switch-controlled lighting outlet shall be installed to provide illumination on the exterior side of each outdoor egress door having grade level access****, including outdoor egress doors for attached garages and detached garages with electric power. A vehicle door in a garage shall not be considered as an outdoor egress door. Where one or more lighting outlets are installed for interior stairways, there shall be a wall switch at each floor level and landing level that includes an entryway to control the lighting outlets where the stairway between floor levels has six or more risers.*

> ***Exception:*** *In hallways, stairways, and at outdoor egress doors, remote, central, or automatic control of lighting shall be permitted.*

The proposed revisions create separate sections for interior stairways and exterior doorways. It eliminates a term that is difficult to enforce - “immediate vicinity”. It uses the same text found in the electrical code to identify the light location at exterior doors and the exception addressing controls. Some text is editorially revised to eliminate repetitive language but the basic intent is left unchanged. The light levels and exceptions are retained as they are in the current rule. It is believed that this change helps to eliminate some confusion and improve uniformity of application and creates consistency between the building and electrical portions of the IRC.

Cost Impact: None

RB102-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.7-RB-DAVIDSON

RB103 – 13
R303.7

Proponent: Wesley Walters, Clark County Nevada Development Services, representing self

Revise as follows:

R303.7 Stairway illumination. All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. For interior stairs the artificial light sources shall be capable of illuminating treads and landings to levels not less than 1 footcandle (11 lux) measured at the center of treads and landings. Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a *basement* from the outside *grade* level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway.

Exception: An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each ~~stairway~~ stair section.

Reason: Stairway defines the whole area including the landings. The commentary shows the light source centered over each flight of stairs so the proper definition word choice would be "stair" not stairway.

Cost Impact: The code change proposal will not increase the cost of construction.

RB103-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.7-RB-WALTERS

RB104 – 13
R202, R303.8

Proponent: Jonathan Siu, representing City of Seattle Department of Planning & Development (jon.siu@seattle.gov)

Revise as follows:

SECTION R202
DEFINITIONS

COURT. A minimum 3-foot wide space on the *lot* on which a building is situated, open and unobstructed to the sky, located at or above *grade* level on a *lot* and bounded on three or more sides by walls or a building. The distance shall be measured at a right angle from the face of the walls.

YARD. ~~An~~ A minimum 3-foot wide open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the *lot* on which a building is situated. The distance shall be measured at a right angle from the face of the wall.

Revise as follows:

R303.8 Required glazed openings. Required glazed openings shall open directly onto a street or public alley, or a *yard* or court ~~located on the same *lot* as the building~~.

Exceptions:

1. Required glazed openings may face into a roofed porch where the porch abuts a street, *yard* or court and the longer side of the porch is at least 65 percent unobstructed and the ceiling height is not less than 7 feet (2134 mm).
2. Eave projections shall not be considered as obstructing the clear open space of a *yard* or court.
3. Required glazed openings may face into the area under a deck, balcony, bay or floor cantilever provided a clear vertical space at least 36 inches (914 mm) in height is provided.

Reason:

1. The intent of the proposed change to the definition of "court" is to clarify that the court must be on the same property as the building under consideration. This aligns its definition with that for "yard", since "court" only appears in conjunction with "yard" in this code. This proposal also reinforces a general (but unstated) principle in all the I-codes that a building cannot rely on features on an adjacent property to demonstrate compliance with the code. That is, each building must demonstrate compliance within its own property lines unless specifically provided for in the code, such as in Footnote a to Table R302.1(2), or for spaces such as rights-of way.
2. The reason for adding the 3-foot dimension to the definitions for "yard" and "court" is that their minimum dimension is not defined. The 3-foot dimension was chosen because it is consistent with the requirements for minimum separation distance for walls (Table R302.1(2)) and for minimum width of a window well for emergency escape windows (Section R310.2). The requirement to measure the 3 feet perpendicular to the wall is copied from the definition for "Fire Separation Distance" in Chapter 2.

   Such a minimum dimension is needed to define what size yard or court is eligible for consideration of:

   A. What can be called a townhouse. The definition for "townhouse" states the dwelling unit must have a yard or public way on at least two sides. However, because the code does not define a minimum dimension for the yard, a designer can argue that a 1-foot or even a 1-inch distance constitutes a yard, and therefore, dwelling units close to the property line may be considered townhouses. (See Figure 1 below.) That interpretation does not agree with the commonly understood concept of what constitutes a townhouse, so this proposal provides clear guidance to the designer and the building official.
   B. What can be used for light and ventilation. Section 303.8 requires that glazed openings used for light and ventilation open into a yard or court. Similar to the argument for "townhouse," a minimum dimension is necessary because the current code provisions could be construed to allow these openings to comply by receiving light and ventilation from a very small

space. It stands to reason that some minimum space is required in order to allow sufficient light and ventilation to enter through the opening.

C. What can be used for a pathway to get to a right-of-way from an emergency escape and rescue opening. Section 310.1 requires emergency escape and rescue openings to open "directly into a public way, or to a yard or court that opens to a public way." However, an inadequate width of yard or court would render the emergency escape opening useless. Section R310.2 requires a minimum 3-foot wide window well for below-grade emergency escape and rescue openings, and if at least 3 feet is required for a window well, it stands to reason a yard or court should be at least 3 feet wide as well, in order to provide an adequate pathway to the right-of-way.

It is to be noted that defining a yard as having a width of at least 3 feet will not adversely affect sections different from those mentioned above where "yard" is used (Table R302.1(2), Section R303.8.1, and in Appendix M, Sections AM103.1.1 and AM103.1.3). "Court" is not used in any sections other than those mentioned above.

3. The text being proposed for deletion in Section R303.8 is redundant with the proposed definition of "court" and the existing definition of "yard."

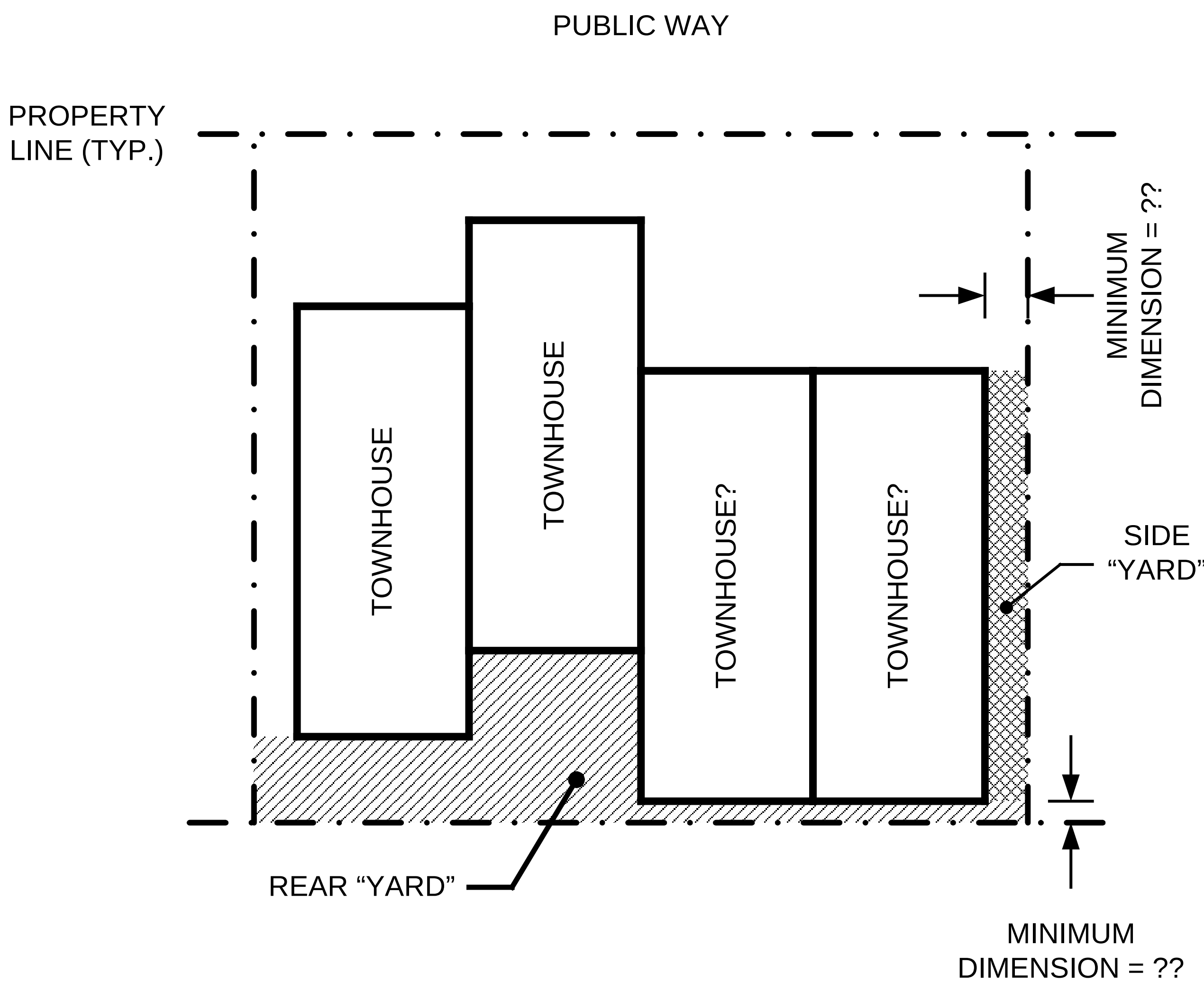


FIGURE 1 – PLAN VIEW

Cost Impact: Minimal, if any, increase to the cost of construction.

RB104-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R303.8-RB-SIU

RB105 – 13
R304, R305.1, R202

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

SECTION R202
DEFINITIONS

ATTIC, HABITABLE. A finished or unfinished area, not considered a *story*, complying with all of the following requirements:

~~1. The occupiable floor area is at least 70 square feet (17 m2), in accordance with Section R304,~~
1.~~2~~ The occupiable floor area has a ceiling height in accordance with Section R305, and
2.~~3~~ The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.

~~**SECTION R304**~~
~~**MINIMUM ROOM AREAS**~~

~~**R304.1 Minimum area.** Every *dwelling* unit shall have at least one habitable room that shall have not less than 120 square feet (11 m2) of gross floor area.~~

~~**R304.2 Other rooms.** Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m2).~~

~~**Exception:** Kitchens.~~

~~**R304.3 Minimum dimensions.** Habitable rooms shall not be less than 7 feet (2134 mm) in any horizontal dimension.~~

~~**Exception:** Kitchens.~~

~~**R304.4 Height effect on room area.** Portions of a room with a sloping ceiling measuring less than 5 feet (1524 mm) or a furred ceiling measuring less than 7 feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.~~

SECTION R305
CEILING HEIGHT

R305.1 Minimum height. *Habitable space*, hallways, bathrooms, toilet rooms, laundry rooms and portions of *basements* containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm).

Exceptions:

1. For rooms with sloped ceilings, at least ~~50 percent of the required floor area~~ 35 square feet of floor area of the room must have a ceiling height of at least 7 feet (2134 mm) and no portion of the required floor area may have a ceiling height of less than 5 feet (1524 mm).
2. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) at the center of the front clearance area for fixtures as shown in Figure R307.1. The ceiling height above fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a minimum ceiling height of 6 feet 8

inches (2032 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

R305.1.1 Basements. Portions of *basements* that do not contain *habitable space*, hallways, bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exception: Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.

Reason: Minimum room sizes began to appear in model codes around the time of WWII. But their origin traces back to the tenement regulations in larger cities in the late 1800's. These room sizes are of necessity arbitrary because they were not based on any scientific studies. They are not based on the number of people who may safely occupy a space. The rules have outlived their usefulness and are no long necessary. People occupy spaces considered small for all or portions of their day including work cubicles and vehicles. And, it isn't hard to find news articles about small trendy dwelling units that exist due to costs caused by both construction and demand. These are no longer considered unsafe.

The market drives room sizes in large part for new construction. It is unlikely that there are many homebuyers that would opt for a living room or bedroom of 50 square feet. But even if they did, would that create a hazardous, unhealthy, or dangerous situation?

Considering that required ceiling heights are only required in 35 square feet of a room with a sloped ceiling, one wonders if enforcing the rule is worth it. It is doubtful that plan reviewers ever calculate room sizes during a plan review.

And as the rule applies to existing dwellings, installation of rooms in unfinished basements (where this is most likely to come into play) will only result in rooms being identified as non-habitable or work will be done without permits. Then other safety features such as smoke alarms and egress windows may be avoided.

It is time to focus resources on requirements that are more beneficial to the public and eliminate the micromanaging.

Cost Impact: None

RB304-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R304-RB-DAVIDSON

RB106 – 13
R304.1, R304.2

Proponent: Thomas Meyers, CBO representing self (Codeconsultant@gmail.com)

Revise as follows:

R304.1 Minimum area. ~~Every *dwelling* unit shall have at least one habitable room that shall have not less than 120 square feet (11 m2) of gross floor area.~~

~~**R304.2 Other rooms.**~~ ~~Other~~ Habitable rooms shall have a floor area of not less than 70 square feet (6.5 m2).

Exception: Kitchens.

Reason: The code has long provided a minimum room area that was historically accommodated by market expectation. Recently, proponents of minimalist living have advocated living in smaller dwellings to reduce environmental impact and provide for lower living costs through reduced mortgage and maintenance expenses. These dwellings are intended to allow for a minimalist lifestyle that doesn't demand large volumes of living space. Extreme examples of these "minimalist" dwellings may be found by using search engine term "tiny house".

During the past three years, I have attempted to research the basis of the requirement for the minimum room area. There is little, if any, documentation on the life safety benefit of having a certain area provided as a minimum. Logically, there is no real benefit to a minimum area provided that the activities necessary in "dwelling" may be accommodated within the space provided. The code has previously set a minimum of 70sf to perform any "habitable" use. Therefore, that is the value that should be applicable throughout.

Removal of this requirement may provide for a gain in overall life safety. My research indicates that a considerable number of these structures are purposefully built to evade building code oversight. The main reason cited is the minimum area provisions. If the code reduced the minimum area to 70sf, the main objective would be removed.

Consumers make a purposeful and informed decision as to the appropriateness of the housing they choose to live in. It isn't appropriate that the code place arbitrary restrictions that have no demonstrable life-safety benefit.

Cost Impact: Proposed change will reduce the cost of construction

RB106-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R304.1-RB-MEYERS

RB107 – 13
R305.1, R305.1.1

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

SECTION R305
CEILING HEIGHT

R305.1 Minimum height. *Habitable space*, hallways, bathrooms, toilet rooms, laundry rooms and portions of *basements* containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm).

Exceptions:

1. For rooms with sloped ceilings, at least 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet (2134 mm) and no portion of the required floor area may have a ceiling height of less than 5 feet (1524 mm).
2. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) at the center of the front clearance area for fixtures as shown in Figure R307.1. The ceiling height above fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.
3. In portions of basements and detached accessory structures not containing habitable space, the spaces shall have a minimum headroom of 6 feet 8 inches (2032 mm). Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.

~~**R305.1.1 Basements.** Portions of *basements* that do not contain *habitable space*, hallways, bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).~~

~~**Exception:** Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.~~

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The BCAC decided that the current language for basement ceiling heights created some confusion with the double negative. In addition, the BCAC decided that requiring a minimum 7 foot ceiling clearance in non-habitable portions of basements containing mechanical rooms, bathrooms and laundry rooms was overly restrictive.

Cost Impact: None

RB107-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R305.1-RB-BAJNAI-BCAC

RB108 – 13
R305.1, R305.1.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

SECTION R305
CEILING HEIGHT

R305.1 Minimum height. *Habitable space*, hallways, ~~bathrooms, toilet rooms, laundry rooms~~ and portions of *basements* containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

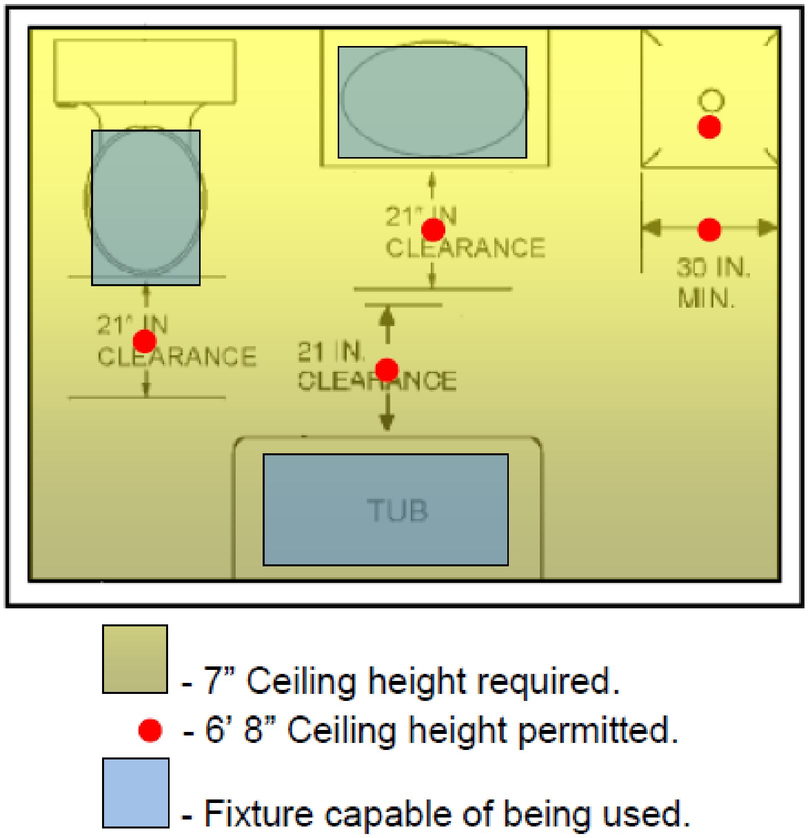
Exceptions:

1. For rooms with sloped ceilings, at least 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet (2134 mm) and no portion of the required floor area may have a ceiling height of less than 5 feet (1524 mm).
2. ~~Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) at the center of the front clearance area for fixtures as shown in Figure R307.1.~~ The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

R305.1.1 Basements. Portions of *basements* that do not contain *habitable space*~~,~~ or hallways~~, bathrooms, toilet rooms and laundry rooms~~ shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exception: Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.

Reason: This proposal sets the required ceiling height for bathrooms, toilet rooms, and laundry rooms at 6 feet 8 inches. The current language requires ceiling heights in these spaces to be 7 feet. Then the exception allows the ceiling height to be 6 feet 8 inches in front of the fixtures (the most used area of the space) so the exception is really the rule. It only makes sense that the entire room be permitted to be 6 feet 8 inches, not just the most used areas of the room.



Cost Impact: None

RB108-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R305.1-RB-DAVIDSON

RB109 – 13
R307.2

Proponent: David Hall CFM, Georgetown, Texas representing the ICC PMG Code Action Committee (Dave.Hall@georgetown.org); Roger Harper, Louisa County, VA, representing Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association (VBCOA) and ICC Region 7 (sharper@louisa.org); Richard Grace of Fairfax County representing Virginia Plumbing and Mechanical Inspectors Association and Virginia Building and Code Officials Association (Richard.Grace@fairfaxcounty.gov)

Delete and substitute as follows:

~~**R307.2 Bathtub and shower spaces.** Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor.~~

R307.2 Bathtub and shower floors and walls. Bathtub floors, shower floors, wall areas above built-in tubs that have installed shower heads and walls in shower compartments shall be constructed of smooth, corrosion-resistant and nonabsorbent waterproof materials. Wall materials shall extend to a height of not less than 6 feet (1829 mm) above the room floor level and not less than 70 inches (1778 mm) above the drain of the tub or shower. Such walls shall form a water-tight joint with each other and with either the tub or shower floor.

Reason: This revised language was approved for the 2015 IPC. There is no reason for the two codes to have different language.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes. For PMGCAC member reference, this was Item no. X8 on the PMGCAC IRC-P list.

Cost Impact: The code change proposal will not increase the cost of construction.

RP109-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R307.2-RB-HALL-PMGCAC

RB110 – 13
R308.1, R308.1.1, R308.3, R308.4

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R308.1 ~~Identification.~~ ~~Except as indicated in Section R308.1.1 each~~ **Required.** Every pane of glazing ~~installed in hazardous locations as defined in SectionR308.4~~ shall meet the requirements of R308.3.1 and shall be provided with a manufacturer's designation specifying who applied the designation, designating the type of glass and the safety glazing standard with which it complies, which is visible in the final installation. The designation shall be acid etched, sandblasted, ceramic-fired, laser etched, embossed, or be of a type which once applied cannot be removed without being destroyed. ~~A *label* shall be permitted in lieu of the manufacturer's designation.~~

Exception~~s~~:

~~1.~~ ~~For other than tempered glass, manufacturer's designations are not required provided the *building official* approves the use of a certificate, affidavit or other evidence confirming compliance with this code.~~

~~2.~~ Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation.

~~**R308.1.1 Identification of multiple assemblies.** Multipane assemblies having individual panes not exceeding 1 square foot (0.09 m^2) in exposed area shall have at least one pane in the assembly identified in accordance with Section R308.1. All other panes in the assembly shall be *labeled* "CPSC 16 CFR 1201" or "ANSI Z97.1" as appropriate.~~

R308.2 Louvered windows or jalousies. Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal 3/16 inch (5 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

R308.2.1 Wired glass prohibited. Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

R308.3 Human impact loads. Individual glazed areas, including glass mirrors ~~in hazardous locations such as those indicated as defined in Section R308.4~~, shall pass the test requirements of Section R308.3.1.

Exceptions:

1. Louvered windows and jalousies shall comply with Section R308.2.
2. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.
3. Glass unit masonry complying with Section R610.

R308.3.1 Impact test. Where required by other sections of the code, glazing shall be tested in accordance with CPSC 16 CFR 1201. Glazing shall comply with the test criteria for Category I or II as indicated in Table R308.3.1(1).

Exception: Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A or B as indicated in Table R308.3.1 (2).

~~**R308.4 Hazardous locations.** The locations specified in Sections R308.4.1 through R308.4.7 shall be considered specific hazardous locations for the purposes of glazing.~~

~~**R308.4.1 Glazing in doors.** Glazing in all fixed and operable panels of swinging, sliding and bifold doors shall be considered a hazardous location.~~

~~**Exceptions:**~~

1. ~~Glazed openings of a size through which a 3-inch-diameter (76 mm) sphere is unable to pass.~~
2. ~~Decorative glazing.~~

~~**R308.4.2 Glazing adjacent doors.** Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface shall be considered a hazardous location.~~

~~**Exceptions:**~~

1. ~~Decorative glazing.~~
2. ~~When there is an intervening wall or other permanent barrier between the door and the glazing.~~
3. ~~Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position.~~
4. ~~Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with section R308.4.3.~~
5. ~~Glazing that is adjacent to the fixed panel of patio doors.~~

~~**R308.4.3 Glazing in windows.** Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered a hazardous location:~~

1. ~~The exposed area of an individual pane is larger than 9 square feet (0.836 m^2);~~
2. ~~The bottom edge of the glazing is less than 18 inches (457 mm) above the floor;~~
3. ~~The top edge of the glazing is more than 36 inches (914 mm) above the floor; and~~
4. ~~One or more walking surfaces are within 36 inches (914 mm), measured horizontally and in a straight line, of the glazing.~~

~~**Exceptions:**~~

1. ~~Decorative glazing.~~
2. ~~When a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of $1^1/_2$ inches (38 mm) in cross sectional height.~~
3. ~~Outboard panes in insulating glass units and other multiple glazed panels when the bottom edge of the glass is 25 feet (7620 mm) or more above *grade*, a roof, walking surfaces or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.~~

~~**R308.4.4 Glazing in guards and railings.** Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered a hazardous location.~~

~~**R308.4.5 Glazing and wet surfaces.** Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where~~

~~the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered a hazardous location. This shall apply to single glazing and all panes in multiple glazing.~~

> ~~**Exception:** Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool, or swimming pool.~~

~~**R308.4.6 Glazing adjacent stairs and ramps.** Glazing where the bottom exposed edge of the glazing is less than 36 inches (914 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered a hazardous location.~~

~~**Exceptions:**~~

1. ~~When a rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of $1^1/_2$ inches (38 mm) in cross sectional height.~~
2. ~~Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.~~

~~**R308.4.7 Glazing adjacent to the bottom stair landing.** Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches (914 mm) above the landing and within 60 inches (1524 mm) horizontally of the bottom tread shall be considered a hazardous location.~~

> ~~**Exception:** The glazing is protected by a guard complying with Section R312 and the plane of the glass is more than 18 inches (457 mm) from the guard.~~

Reason: We have all heard the warnings from the media and the National Weather Service during certain weather events asking people to take shelter and "stay away from windows". Why? Windows are the weak link in protection from flying debris and hail. Windows allow debris to enter homes. Windows can be a danger in certain weather conditions and from certain common everyday events. Occupants are put at risk from this flying debris or from flying glass. Flying shards of glass can become deadly missiles. Homes with shattered windows are more susceptible to interior damage and greater wind damage increasing repair costs and insurance premiums.

Tempered glass is 4-5 times stronger than non-tempered glass. Using tempered glass or other safety glazing products will increase the safety of homes during certain weather events by reducing the amount of flying debris entering the home, reducing flying glass, and adding greater protection against the elements for the home.

But weather events aren't the only reason to require all glazing to be safety glazing. In earthquake prone areas, shattered glass is a reality and a safety hazard.

And, normal activities in the home can quickly turn tragic and involve serious injury. In the last code cycle, Thomas S. Zaremba, Roetzel & Andress, representing Glazing Industry Code Committee stated during the ICC hearings: "The assumption that people are familiar with their home environment does not take into consideration guests, rental units, or accidental impacts, for example, resulting from horseplay, that can result in human impact with glazing …" Children playing in or about the home can come into contact with glazing that is not now required to be safety glazed resulting in serious injuries. Children and adults can accidentally fall into window wells contacting the glass in a downward fall. News reports periodically highlight these events such as the Oklahoma lady who was cut by flying glass when a neighbor child's baseball hit her window or of the children in Ohio that were cut by flying glass when a tree fell against their home in a storm.

Because of its added strength, safety glazing creates more of a barrier to intruders which in turn increases the personal safety level in the home.

There are significant benefits to be had by requiring all glass in a home to be safety glazed. They can reduce injuries and related health care costs and because of the increased strength, may help to reduce break-ins.

The rules themselves as they are currently written are full of arbitrary limitations. Consider this: A window that is at floor level and that is 8.9 square feet need not be safety glazed while a window that is .1 sq feet larger and 17 inches off the floor must be safety glazed. Children are just as likely to run into and be harmed regardless the size. Flying shards of glass are dangerous no matter what size window they come out of or no matter how high off the floor they fall from. Windows can be struck by flying debris at any height. The higher the glass is off the floor, the more dangerous it is when it falls.

Entire industries have popped up that provide various films for placement over windows to make the glass safer from the standpoint of intrusion, damage from weather, and other safety glazing reasons. Why not just require safety glazing to begin with. Tempered glass is even more resistant to breakage from fire in an adjoining building.

It is amazing that with all of the news articles written about the dangers of glass that industry hasn't taken on the responsibility of installing safety glazing in all of their products. The technology is there. The cost is minimal compared to the many code changes that have been approved in recent years to prevent incidents that by any means would be rare; the underfloor fire protection to protect fire fighters comes immediately to mind. Accidents related to breaking glass could occur at any time in any dwelling with any occupant. And unlike a fire, are more likely to involve entire communities. It is time to make homes safer for the occupants.

Cost Impact: This proposal will increase the cost of construction.

RB110-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.1-RB-DAVIDSON

RB11 – 13
R308.4.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

R308.4.2 Glazing adjacent doors. Glazing in an individual fixed or operable panel adjacent to a door shall be considered a hazardous location ~~where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where~~ if the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface ~~shall be considered a hazardous location~~ and it meets either of the following conditions:

1. Where the glazing is within 24” of either side of the door in the plane of the door in a closed position,
2. Where the glazing is on a wall perpendicular to the plane of the door in a closed position and within 24” of the hinge side of an in-swinging door.

Exceptions:

1. Decorative glazing.
2. When there is an intervening wall or other permanent barrier between the door and the glazing.
3. ~~Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position~~
4. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with section R308.4.3.
5. Glazing that is adjacent to the fixed panel of patio doors.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

Exception 3: Currently the code requires safety glazing for windows on the hinge side of walls perpendicular to the door plane – regardless of the door swing. See sketch below.

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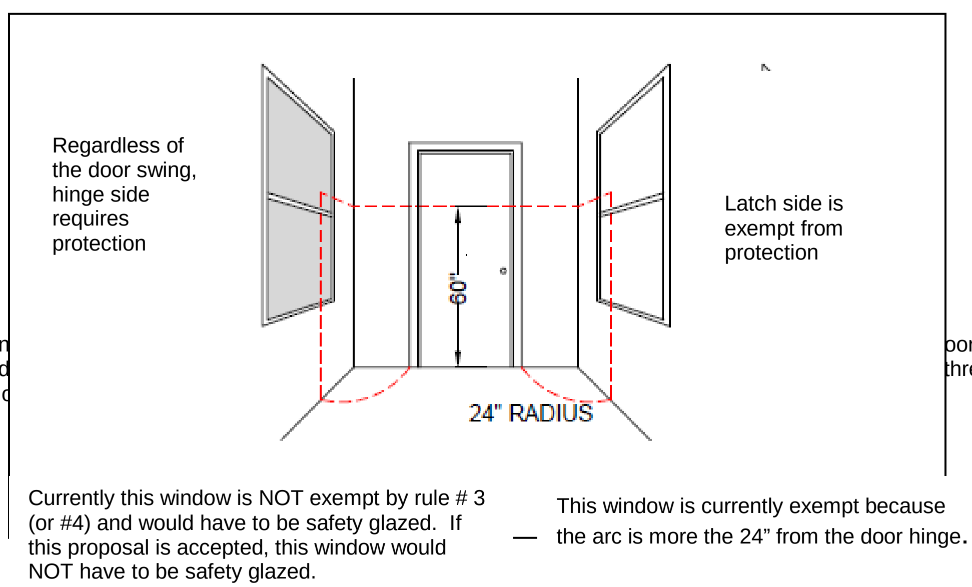

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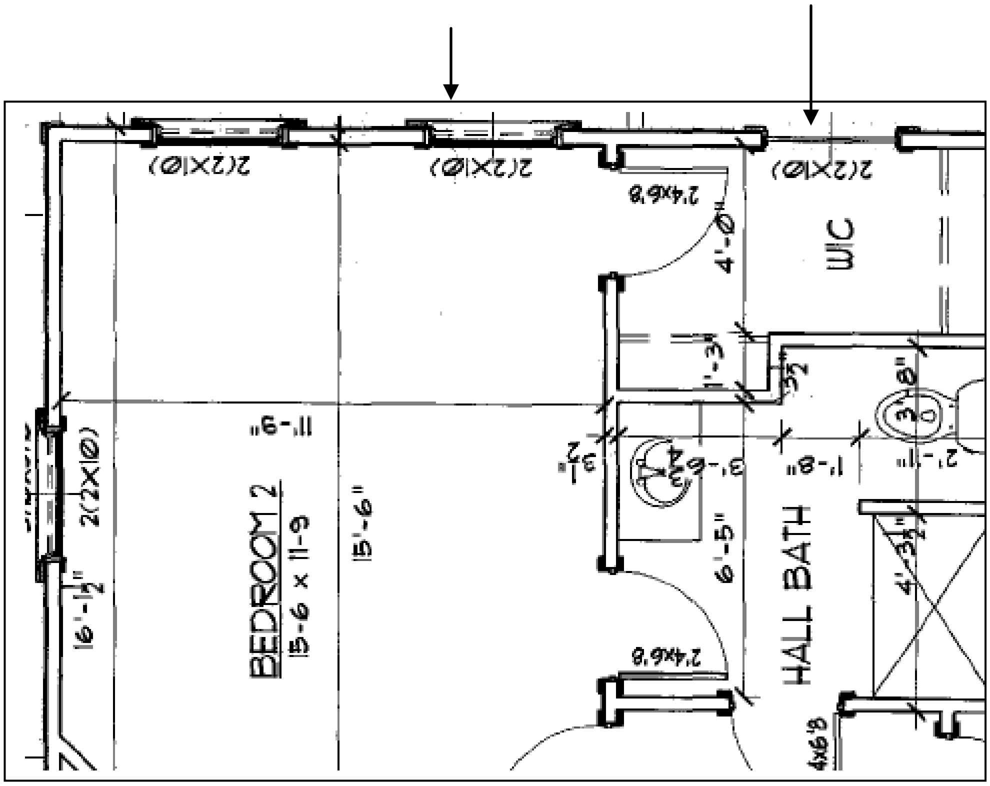
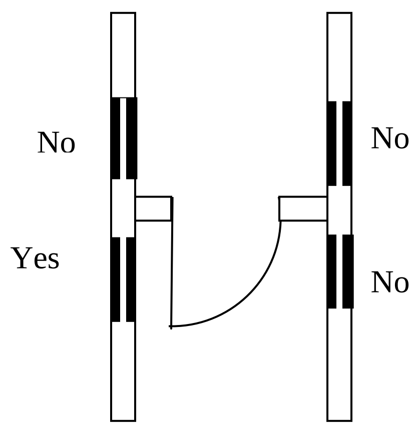




These are the four possible configurations of windows adjacent/perpendicular to a door. Only the one with an in-swinging door on the hinge side would be required to be safety glazed.

Cost Impact: This proposal may decrease the cost of construction.

RB111-13

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

R308.4.2 #1-RB-BAJNAI-BCAC

RB112 – 13
R308.4.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov)

Revise as follows:

R308.4.2 Glazing adjacent doors. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface shall be considered a hazardous location.

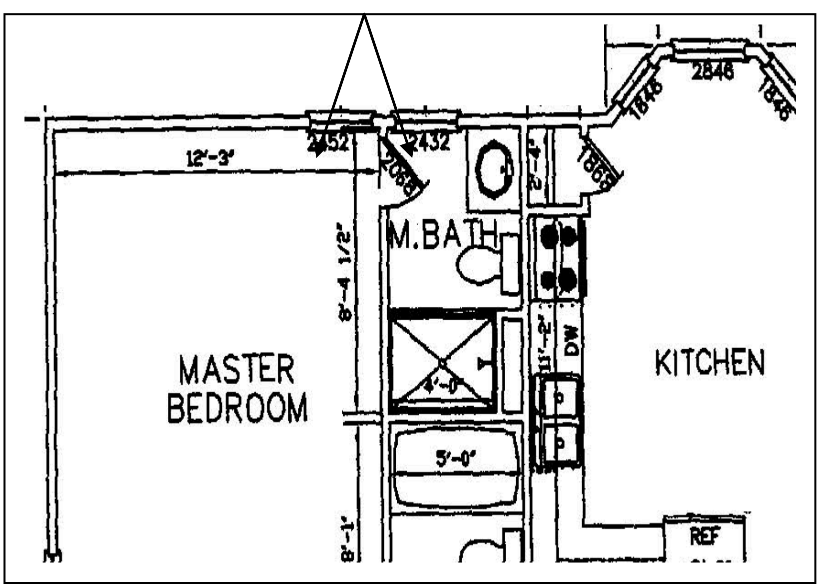
Exceptions:

1. Decorative glazing.
2. When there is an intervening wall or other permanent barrier between the door and the glazing.
3. Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position
4. Where access through the door is to a closet or bathroom ~~or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with section R308.4.3~~.
5. Glazing that is adjacent to the fixed panel of patio doors.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

1. There is some confusing language in this section trying to acknowledge that the requirements in Section R308.4 may overlap and how to handle them. Adding this sentence in R308.4 says that you have to comply with all of the requirements in this section – even if you get an exception in one part, you might still have to comply by a different rule. That is what the second sentence in Exception 4 of R308.4.2 is trying to do.
2. Currently the code requires safety glazing in windows within 24" arc of the hinge side of a door for walls perpendicular to the door swing.

Currently both of these windows would have to be safety glazed. By this proposed code change, neither window would have to be safety glazed because the door is to a bathroom



Because the situation is familiar to the home occupants, and most of the time the bathroom or closet would be serving one or two people on a very limited basis, the threat of danger is not present.

Cost Impact: This proposal may decrease the cost of construction.

RB112-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.4.2 #2-RB-BAJNAI-BCAC

RB113 – 13
R308.4.5

Proponent: Tim Pate, City and County of Broomfield, CO, representing the Colorado Chapter Code Change Committee

Revise as follows:

R308.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered a hazardous location. This shall apply to single glazing and all panes in multiple glazing.

> **Exception:** Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the ~~water's~~ edge of a bathtub, hot tub, spa, whirlpool, or swimming pool or from the edge of a shower, sauna, or steam room.

Reason: This code change is proposing to add the language "shower, sauna, steam room" to the laundry list in the exception to require safety glazing in locations within and adjacent to areas with wet surfaces. The laundry list should match what is in the main section R308.4.5. This code change will also delete the word "water's" so that it will make sense with the added items. There will typically not be any depth of water in a shower, sauna, or steam room.

This will help provide clarity to the code user to show that if you have glazing at any height above floor and it is at least 60" away from edge of these items it would be exempt from the requirement to have glass be safety glazing. All of these items will potentially have very slippery floor surfaces and if one were to fall down the person would not extend out past 60" with their arms and hands or bodies when falling. This will match the requirements and concept for exception for safety glazing measured from bottom tread of stairs.

Cost Impact: This code change will not increase the cost of construction.

RB113-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.4.5-RB-PATE

RB114 – 13
R308.4.6, R308.4.7

Proponent: Tim Pate, City and County of Broomfield, CO representing Colorado Chapter Code Change Committee

Revise as follows:

R308.4.6 Glazing adjacent to stairs and ramps. Glazing where the bottom exposed edge of the glazing is less than ~~36 inches (914 mm)~~ <u>60 inches (1524 mm)</u> above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered a hazardous location.

Exceptions:

1. When a rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above walking surface. The rail shall be capable of capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1 ½ inches (38 mm) in cross sectional height <u>and the plane of glass is more than 18 inches (457 mm) horizontally from the rail.</u>
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.

R308.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than ~~36 inches (914 mm)~~ <u>60 inches (1524 mm)</u> above the landing and within 60 inches (1524 mm) horizontally of the bottom tread shall be considered a hazardous location.

Exception: The glazing is protected by a guard complying with Section 312 and the plane of the glass is more than 18 inches (457 mm) from the guard.

Reason: All of the previous editions of the IRC required glazing that was had bottom edge below 60 inches above the plane of walking surfaces of stairways, landings between flights of stairs and ramps, and adjacent to stair landings to be approved safety glazing. Code change was approved which changed the 36 inches back to 60 inches. There was a comprehensive code change (S218 09/10) that reformatted the entire safety glazing section and also changed the dimension from 60 inches down to 36 inches. This was approved and overrode my code change.

My reason statement for the code change during the 2009/2010 cycle was very clear in helping clean up the inconsistencies in the earlier codes. As you can see it specifically required the wall with glazing to be at least 18 inches away. The reason statement that the IRC change committee gave in approving the comprehensive change was that it should be lowered to 36" which would match the exception. I could never find a good reason as to why my code change that was approved by the IRC committee did not stand and get incorporated into the overall change also approved by the IRC code change committee.

I am copying my code change (RB40-09/10) and reason statement that the2009/2010 IRC committee agreed with:

Revise as follows:

R308.4 The following shall be considered specific hazardous locations for the purposes of glazing:

Items 1 through 6 remain unchanged

7. Glazing adjacent to stairways, landings, and ramps within 36 inches (914 m) horizontally of a walking surface when the exposed surface of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

Exceptions:

1. ~~When a rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per lineal foot (730 N/m) without contacting the glass and be a minimum of 1 ½ inches (38 mm) in cross sectional height.~~
2. The side of the stairway has a guard~~rail~~ or handrail, including balusters or in-fill panels, complying with Sections R311.7.6 and R312 and the plane of the glazing is more than 18 inches (457 mm) from the railing; or
3. When a solid wall or panel extends from the plane of adjacent walking surface to 34 inches (863 mm) to 36 inches (914 mm) above the walking surface and the construction at the top of that wall or panel is capable of withstanding the same horizontal load as a guard <u>and the plane of the glazing is more than 18 inches (457 mm) from the wall or panel.</u>

8. Glazing adjacent to stairways within 60 inches (1524 m) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glazing is less than 60 inches (1524 mm) above he nose of the tread.

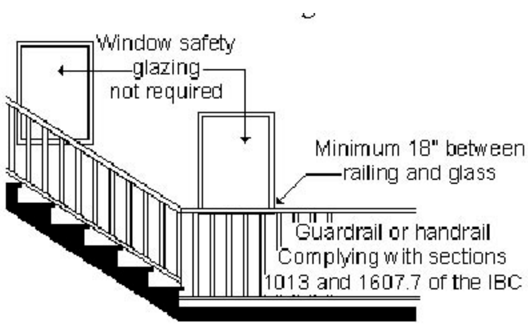
Exceptions:

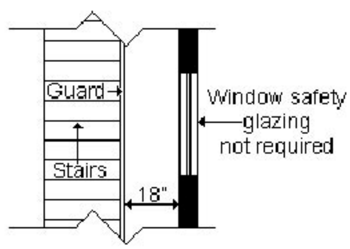
1. The side of the stairway has a guard~~rail~~ or handrail, including balusters or in-fill panels, complying with Sections R311.7.6 and R312 and the plane of the glazing is more than 18 inches (457 mm) from the railing; or
2. When a solid wall or panel extends from the plane of adjacent walking surface to 34 inches (863 mm) to 36 inches (914 mm) above the walking surface and the construction at the top of that wall or panel is capable of withstanding the same horizontal load as a guard and the plane of the glazing is more than 18 inches (457 mm) from the wall or panel.

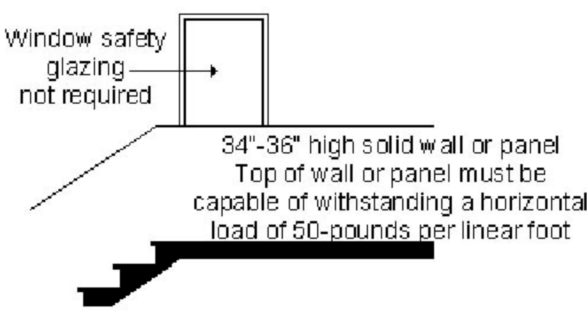
Reason: Code change RB15-00 added exception 9 (9.1 and 9.2) which allowed the protective bar but also required the glazing to be at least 18" away from the stair and bar. Code change RB16-00 was also approved in the same code change cycle which added the reference in exception #5 which would allow the protective bar but not require the 18" separation. This created a direct conflict between the two exceptions in the 2003 IRC and the 2006 IRC. IRC Section R308.4 was modified for the 2009 IRC by reformatting the requirements and exceptions in order to make it more user friendly but no technical changes were made.

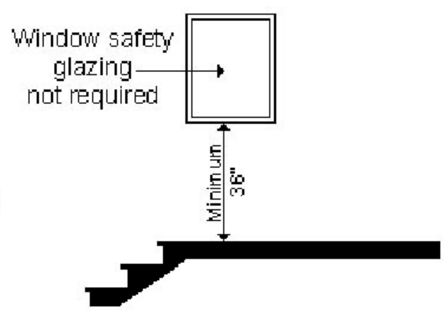
Stairs are inherently more dangerous for tripping hazards than normal walking surfaces. It does not make sense to a allow 1 ½" wide bar or a solid wall directly adjacent to stairs and landings and think this gives adequate protection for someone falling into glazing that is not safety glazing. Requiring the glazing to be at least 18" away would provide better protection if someone trips and falls which is exactly what 2009 IRC section R308.4 #7 Exception 2 requires.

The following diagrams illustrates what R308.4 #7 exception 2 allows which is the guard or handrail but also the 18" separation which is in conflict with what is allowed in #7 exception 1 or 3 which allows a rail or solid wall but does not require the 18" separation.









I was also successful in having the IBC safety glazing section changed back to 60 inches during the past Code Change Hearing in Dallas for the 2015 IBC. Here is the code change (S297-12) to IBC along with the reason statement – this code change was approved by Structural Code Change Committee and was not challenged at Final Action Hearings and therefore was approved on the consent agenda:

Revise as follows:

2406.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than ~~36 inches (914 mm)~~ 60 inches (1524 mm) above the landing and within a 60 inches(1524 mm) horizontally of the bottom tread shall be considered a hazardous location.

Reason: Previous editions of the IBC before the 2012 required glazing that is less than 60" above the landing to be approved safety glazing. It is not clear why this requirement was changed in the 2012. It does not make sense that section 2406.4.6 applies to glazing that is less than 60" above the stairs and intermediate landings but the glazing at bottom landing is treated differently – only when below 36" The potential for falling through the glazing at bottom landing is the same. This change will bring back the 60" height which will then match the requirement at intermediate landings and stairs.

Both 2012 IBC sections 2406.4.6 and 2406.4.7 have exceptions which allow a guard but require the plane of glass to be at least 18" away from the guard.

This code change should be approved in order to make sure that people who use stairs, ramps, and landings remain safe in case they trip and fall and potentially fall through windows adjacent to the stairs and ramps. I do not feel that only protecting glazing that is below 36" above walking surface is adequate but that all glazing below 60" should be protected. The vast majority of people will have their hands and arms outstretched if falling at 48" or so high and would be falling through glass at this height or somewhat higher. Approving this code change will get both the IRC and IBC to match which is extremely important.

Cost Impact: Cost Impact: This code change will increase the cost of construction.

RB114-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.4.6-RB-PATE

RB115 – 13
R308.4.7

Proponent: Tim Pate, City and County of Broomfield, CO representing Colorado Chapter Code Change Committee

Revise as follows:

R308.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches (914 mm above the landing and within a 60 inch~~es~~ (1524 mm) ~~horizontally of~~ horizontal arc less than 180 degrees from the bottom tread nosing shall be considered a hazardous location.

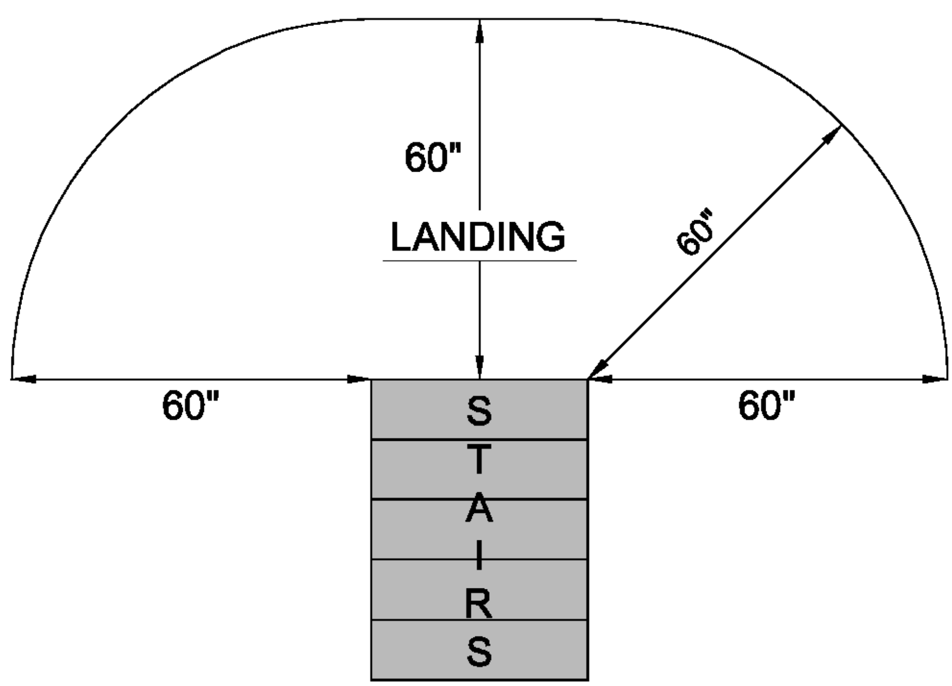
> **Exception:** The glazing is protected by a guard complying with Section 312 and the plane of the glass is more than 18 inches (457 mm) from the guard.

Reason: Previous editions of the IRC before the 2012 required glazing that is 60" horizontally in any direction to be approved safety glazing. It is not clear why this requirement was changed in the 2012. The previous editions had the additional wording "in any direction" when applying the 60" horizontal rule. This is due to the "splay" factor for when someone gets to the last tread and falls. The tendency is for someone to flail out in any direction.

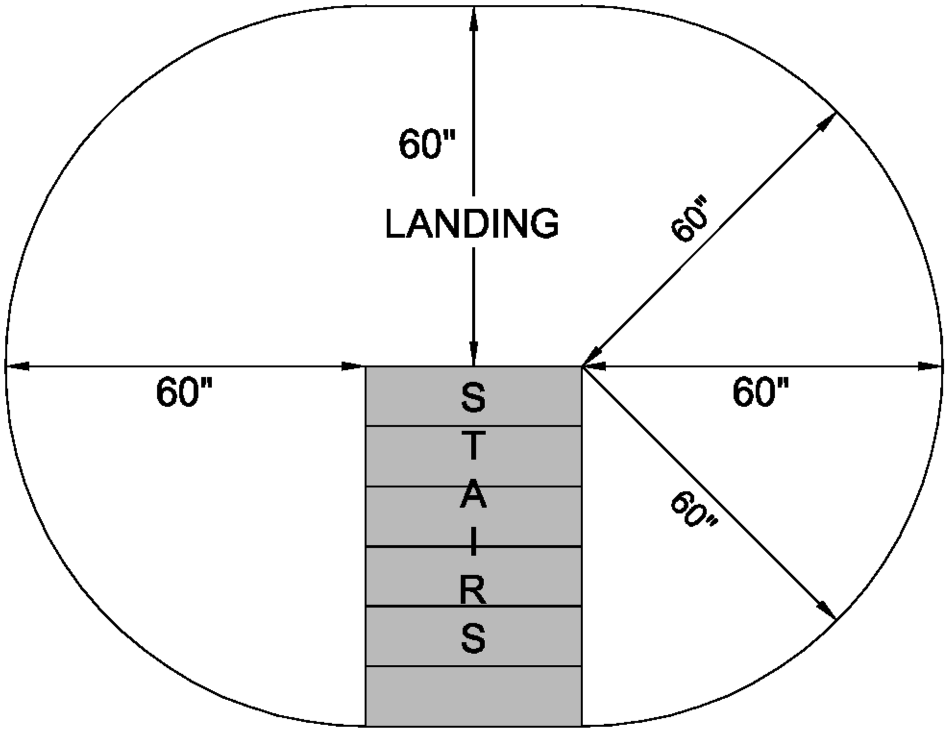
This added wording will make this section only apply to any glazing that is in a wall that is less than 180 degrees from the bottom tread nosing. I believe that adding the wording which would limit the area needing safety glazing to any glazing that falls within a 180 degree arc from bottom tread nosing and extending out 60" makes more sense since it is extremely unlikely that someone will fall out and backwards. I have added an illustration which should help everyone see what this changed wording will do.

Please note that there is still a requirement to provide approved safety glazing when located within 36" horizontally of the sides of the stairs.

The new code language will incorporate the areas shown in the following diagram:



The current code language incorporates the area shown below in the diagram:



This same code change proposal was reviewed and approved at the Final Action Hearings for the 2015 IBC – therefore this proposal for the IRC will get the two code sections to match which is important for consistency.

Cost Impact: This code change will reduce construction cost.

RB115-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.4.7-RB-PATE

RB116 – 13
R308.6.9.1 (New), Chapter 44

Proponent: Jeff Inks, Window and Door Manufacturers Association, representing the Window & Door Manufacturers Association.

Add new text as follows:

R308.6.9 Testing and labeling. Unit skylights and tubular daylighting devices shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

<u>**R308.6.9.1 Comparative analysis for glass-glazed unit skylights.** Structural wind load design pressures for glass-glazed unit skylights different than the size tested in accordance with Section R308.6.9 shall be permitted to be different than the design value of the tested unit when determined in accordance with one of the following comparative analysis methods:</u>

1. <u>Structural wind load design pressures for glass-glazed unit skylights smaller than the size tested in accordance with Section 308.6.9 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the glass-glazed unit skylight having the highest allowable design pressure.</u>
2. <u>In accordance with WDMA I.S. 11.</u>

Add new standard to Chapter 44 as follows:

WDMA Window & Door manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

<u>WDMA I.S.11-13 Analytical Method for Design Pressure Rating of Fenestration Products…..R308.6.9.1</u>

Reason: Comparative analysis based on accepted engineering methods provides a proven, accurate and reliable means for determining design pressures of different sized products within a fenestration product line based on testing of specimen unit/s from the respective line. This alleviates the need for costly testing of all sizes within the line saving considerable construction costs and providing greater design flexibility without incurring additional time and costs, especially for specialty/custom products, for testing that isn't necessary in order to determine the correct DP.

Currently the IRC only allows comparative analysis for windows and doors in Section 612.3.1 which has been and continues to be widely utilized for those products for the reasons stated above. Since comparative analysis as noted above is equally applicable to glass-glazed unit skylights, it should also be permitted by the IRC for them.

Proposed method #1 is taken verbatim from the existing comparative analysis provision in Section 612.3.1 except for substituting "glass-glazed unit skylights" for "windows and door units". However, the existing provision is limited only to allowing comparative analysis for units smaller than the unit tested, not larger. Because comparative analysis can also be effectively used to accurately determine DP ratings for fenestration products that are larger in width and/or height than the actual tested specimen/s provided proper analytical methods are followed, it should also be permitted by the IRC for glass-glazed unit skylights for that purpose as long as proper engineering analysis is required.

The intent of this proposal is to provide for that by allowing for comparative analysis to also be used on units larger than the tested unit if determined in accordance with proposed method #2 -- WDMA I.S. 11. WDMA I.S. 11 - *Industry Standard for Voluntary Analytical Method for Design Pressure (DP) Ratings of Fenestration Products*, provides more comprehensive alternative methods appropriate for using comparative analysis to determine DP of units different in size, both smaller and larger, than that of the tested unit/s within a product line. The comparative analysis methods included in WDMA I.S. 11 are based on accepted engineering analysis which must also be sealed by a licensed Professional Engineer (PE) making it technically sound for use in the IRC for this purpose. This same alternative method is also being proposed for Section 612.3.1 for windows and doors for the same reasons.

Copies of the standard are being submitted to ICC for ICC and IRC code committee review accordingly. The standard is also available on WDMA's website via the following link: https://www.wdma.com/OnlineBookstore/tabid/61/pid/20/WDMA-I-S-11-09-Voluntary-Analytical-Method-for-Design-Pressure-Rating-of-Fenestration-Products-PDF-Download.aspx

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, [WDMA I.S.11-13] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB116-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R308.6.9.1 (NEW)-RB-INKS

RB117 – 13
R310

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov)

Delete and substitute as follows:

R310
EMERGENCY ESCAPE AND RESCUE OPENINGS

~~**R310.1 Emergency escape and rescue required.** Basements, habitable attics and every sleeping room shall have at least one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, emergency egress and rescue opening shall be required in each sleeping room. Where emergency escape and rescue openings are provided, they shall have a sill height of not more than 44 inches (1118 mm) measured from the finished floor to the bottom of the clear opening. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section R310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency and escape rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.~~

> ~~**Exception:** Storm shelters and basements used only to house mechanical equipment not exceeding total floor area of 200 square feet (18.58 m2)~~

~~**R310.1.1 Minimum opening area.** All emergency and escape rescue openings shall have a minimum met clear opening of 5.7 square feet.~~

> ~~**Exception:** Grade floor openings shall have a minimum net clear opening of 5 square feet.~~

~~**R310.1.2 Minimum opening height.** The minimum net clear opening height shall be 24 inches.~~

~~**R310.1.3 Minimum opening width.** The minimum net clear opening width shall be 20 inches (508 mm).~~

~~**R310.1.4 Operational constraints.** Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge.~~

~~**R310.2 Window wells.** The minimum horizontal area of the window well shall be 9 square feet (0.9 m2), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.~~

> ~~**Exception:** The ladder or steps required by SectionR310.2.1 shall be permitted to encroach a maximum of 6 inches (152mm) into the required dimensions of the window well.~~

~~**R310.2.1 Ladder and steps.** Window wells with a vertical depth greater than 44 inches (1118 m) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.7 and R311.8. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457mm)on center vertically for the full height of the window well.~~

~~**R310.2.2 Drainage.** Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R504.1 or by an approved alternative method.~~

~~**Exception:** A drainage system for window wells is not required when the foundation is on well-drained soil or sand-gravel mixture soils according to the United Soil Classification System, Group I Soils, as detailed in Table R405.1.~~

~~**R310.3 Bulkhead enclosures.** Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by Section R310.1.1. Bulkhead enclosures shall also comply with Section R311.7.8.2.~~

~~**R310.4 Bars, grilles, covers and screens.** Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Sections R310.1.1 to R310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening.~~

~~**R310.5 Emergency escape windows under decks and porches.** Emergency escape windows are allowed to be installed under decks and porches provided the location of the deck allows the emergency escape window to be fully opened and provides a path not less than 36 inches (914 mm) in height to a yard or court.~~

R310.1 Emergency escape and rescue opening required. Basements, habitable attics and every sleeping room shall have at least one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way.

Exception: Storm shelters and basements used only to house mechanical equipment not exceeding a total floor area of 200 square feet (18.58 m2)

R310. 1.1 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge.

R310.2 Emergency escape and rescue openings. Emergency and escape rescue openings shall have minimum dimensions as specified in this section.

R310.2.1 Minimum opening area. All emergency and escape rescue openings shall have a minimum net clear opening of 5.7 square feet. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. The minimum net clear height opening shall be 24" and the minimum net clear width shall be 20"

Exception: Grade floor or below-grade openings shall have a minimum net clear opening of 5 square feet.

R310.2.2 Window sill height. Where a window is provided as the emergency escape and rescue opening, it shall have a sill height of not more than 44 inches (1118 mm) above the floor; if the sill height is below-grade, it shall be provided with a window well in accordance with Section R310.2.3.

R310.2.3 Window wells. The minimum horizontal area of the window well shall be 9 square feet (0.9 m2), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section R310.2.1 shall be permitted to encroach a maximum of 6 inches (152mm) into the required dimensions of the window well.

R310.2.3.1 Ladder and steps. Window wells with a vertical depth greater than 44 inches (1118 m) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections R311.7 and R311.8. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457mm)on center vertically for the full height of the window well.

R310.2.3.2 Drainage. Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R504.1 or by an approved alternative method.

> **Exception:** A drainage system for window wells is not required when the foundation is on well-drained soil or sand-gravel mixture soils according to the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.2.4 Emergency escape and rescue openings under decks and porches. Emergency escape and rescue openings shall be permitted to be installed under decks and porches provided the location of the deck allows the emergency escape and rescue openings to be fully opened and provides a path not less than 36 inches (914 mm) in height to a yard or court.

R310.3 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be permitted to be a side hinged door or a slider. Where the opening is below the adjacent ground elevation, it shall be provided with a bulkhead enclosure.

R310.3.1 Minimum door opening size. The minimum net clear height opening for any door that serves as an emergency and escape rescue opening shall be in accordance with Section R310.2.1.

R310.3.2 Bulkhead enclosures. Bulkhead enclosures shall provide direct access from the basement. The bulkhead enclosure shall provide the minimum net clear opening equal to the door in the fully open position.

R310.3.2.1 Drainage. Bulkhead enclosures shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R504.1 or by an approved alternative method.

> **Exception:** A drainage system for bulkhead enclosures is not required when the foundation is on well-drained soil or sand-gravel mixture soils according to the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.4 Bars, grilles, covers and screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Sections R310.1.1 to R310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

This code change is primarily for reorganizational purposes. It separates emergency escape and rescue openings (EERO) window and door provisions, which are currently intermingled. It also says that EERO doors do not have to be "egress" doors, that is, side hinged doors. The new code language allows sliders from basements.

Most people think of emergency escape and rescue openings as windows, and in fact, the current subsections in R310 all seem to define and quantify this type of application: minimum opening height, minimum opening width, window wells, ladders and steps from window wells, drainage from window wells, bars and grilles on windows, windows under decks.
However the most basic EERO is a door. In case of a fire, would prefer to exit through a door or a window? Will a fire fighter prefer to enter through a door or a window?

This revision acknowledges doors as a viable EERO and defines the minimum requirements for EERO doors. It allows side hinged doors or sliders to be used as EEROs.

An EERO door would not have to be an egress door but an egress door would automatically be an EERO door.

Cost Impact: None

RB117-13

Public Hearing:	Committee:	AS	A	M	D
	Assembly:	ASF		AMF	DF

R310.1-RB-BAJNAI-BCAC

RB118 – 13
R310.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R310.1 Emergency escape and rescue required. *Basements,* habitable attics and every sleeping room shall have at least one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section R310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

~~Exception~~ Exceptions:

1. *Basements* used only to house mechanical *equipment* and not exceeding total floor area of 200 square feet (18.58 m^2).
2. Basements and habitable attics of buildings provided with sprinkler systems installed in accordance with Section R313.

Reason: Sprinkler systems are now required in dwellings including their basements. Sprinkler systems weren't required when basement and attic emergency escape and rescue openings went into the code. It is a reasonable trade-off to eliminate emergency escape and rescue openings in basements and attics when homes have sprinkler systems. In addition to sprinklers, new homes are now required to have numerous smoke alarms, carbon monoxide alarms, self-closing fire doors to garages, and under floor fire protection that makes the added expense of these openings unnecessary.

The addition of residential sprinkler requirements added unprecedented cost to the construction of a new home. Eliminating this unnecessary window requirement can help save money that was lost to the cost of sprinklers.

Basement emergency escape and rescue openings that must be installed below grade involve window wells. Window wells add additional cost and maintenance, pose a hazard from falling into the well by persons walking around the dwelling, and are a source of drainage problems during heavy rains. They fill with snow in winter climates and are difficult to clear. Window wells are an ideal hiding place for person's intent on breaking into a home for the purposes of burglary or bodily harm.

The code is silent on the location of basement emergency escape and rescue openings which can lead to their value as an exit being diminished, if nonexistent. The openings are intended to provide a second means of escape if the primary stairs are blocked. But there is no separation requirement for these openings and they could be located at the base of the stairway to the main floor rendering them useless. This can be particularly true in townhouses when there is only one exterior wall in which to locate the opening.

Last, elimination of emergency escape and rescue openings from basements eliminates easy potential entry points for person's intent on burglary, theft, and bodily harm. Statistics show that a person is much more likely to be the target of crime than they are of a fire. This changes even more when sprinklers are installed according to sprinkler advocates. As stated earlier, window wells provide an ideal access point for criminals to access a home. According to the US Justice Department, there are nearly 1 million victimizations of violent crime in a person's own dwelling and nearly 5 million victimizations of property crimes each year.

Cost Impact: None

RB118-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1-RB-DAVIDSON

RB119 – 13
R310.1.1, R310.1.2, R310.1.3, R310.1.5 (NEW)

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R310.1.1 Minimum ~~opening area~~ unobstructed glass area for windows. ~~All~~ Where windows are used as emergency escape and rescue openings, they shall have a minimum ~~net clear opening~~ unobstructed glass area of 5.7 square feet (0.530 m^2).
Exception: *Grade* floor ~~openings~~ windows shall have a minimum ~~net clear opening~~ unobstructed glass area of 5 square feet (0.465 m^2).

R310.1.2 Minimum ~~opening~~ unobstructed glass height. ~~The minimum net clear opening height~~ The minimum unobstructed glass height shall be 24 inches (610 mm).

R310.1.3 Minimum ~~opening~~ unobstructed glass width. ~~The minimum net clear opening width~~ The minimum unobstructed glass width shall be 20 inches (508 mm).

R310.1.4 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge.

R310.1.5 Doors used as emergency escape and rescue openings. Where a door is used to meet the requirements of this section, it shall be of a size that is capable of being used for its intended purpose.

Reason: This is a different and more logical approach to dealing with the size of emergency escape and rescue openings.

The dimensions that are currently being used for egress windows have been cited in ICC Commentaries and in the UBC predecessors as being the result of a study by the San Diego Fire Department. That statement is false. The ICC offices have no copies of any study that was done by the San Diego Fire Department that establishes egress window dimensions nor is there any record of any such study existing nor is there any recollection by ICC staff that they have ever seen such a study. Discussions with long time members of the San Diego Fire Department reveal that the Department never took part in any study to determine the appropriate size of egress windows.

Therefore, it is safe to assume that the dimensions in the code for egress windows exist without any scientific basis.

However, if one is going to have emergency escape and rescue windows, one must have certain size requirements for those windows. But the rules should be reasonable and defensible.

It has been stated by some folks that the reason for the 20 inch width requirement is that it accommodates the width of a fire ladder (20 inches). The area is necessary because "the studies" indicated that such a size (5.7 square feet) is necessary to allow emergency personnel to enter the room through the window wearing necessary safety gear (24 inches of height and 5.7 square ft). I'm not sure how that justifies the 5.0 square foot openings permitted at grade.

I don't know if there is a standard width for ladders or not. But the fallacy that exists is the assumption that the window will be open when a rescue attempt is made. Isn't it more likely that the window will be closed? Isn't it more likely that the following photos depict actual conditions? Isn't it more likely that a rescue person would need to break the window to initiate a rescue? If the ladder is placed in the window opening, won't it impede access into the room, especially with a casement window? Isn't it more reasonable to regulate the rescue opening based on the glass size of the closed window rather than the openable size of the window since that is more than likely how rescue personnel will encounter the window? Won't rescue personnel break out any glass in an opening rather than try to open the window? Of course.

Therefore, it seems to make much more sense to base emergency escape and rescue window requirements on glass size rather than openable area. Even for occupants of the room, it may be more appropriate to break the glass rather than trying to reach operating hardware that may be located where the air is untenable.

Last, there is language proposed to address doors used as rescue and escape openings. The size of the door entering the room is unregulated. This is the primary exit from the room. If a door used as the primary exit is not regulated, why should a secondary door face stricter limits? The proposed language requires that the door be "capable of being used for its intended purpose". This is similar to language approved by the IRC committee in the past and gives the field inspector discretion over door sizes. The inspector may use location, size of the occupant, or whatever limitations seem reasonable to establish the opening size.




Cost Impact: None

RB119-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1.1-RB-DAVIDSON

RB120 – 13
R310.1.4

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R310.1.4 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge. <u>Hardware necessary to operate emergency escape and rescue openings shall not be located more than 48 inches above the floor and shall be operable with one hand. The force required to activate operable parts shall be not more than 5.0 pounds (22.2 N).</u>

(Subsequent sections remain unchanged.)

Reason: The IRC goes to great lengths to regulate the size and location of emergency escape and rescue openings except for the location of operational hardware. There is nothing in the code to prevent operational hardware from being 6 feet above the floor. One of the purposes of the window is to permit emergency escape. But how do people of small stature escape through one of these openings if they cannot reach the operational hardware? This proposal places a modest and reasonable requirement in the code that operational hardware be located within 48 inches of the floor. This would apply to locks and operators. This is consistent with hardware requirements for windows required to be accessible by ANSI A117.1.

The lock location for some typical windows is about 68 inches above the floor. Physiological studies indicate that an average child would need to be at least 9 years old and 4 feet 6 inches in height to operate hardware at that height.

The proposal also includes language from ANSI A117.1 regarding the operation of the window. Difficulty in reaching and operating window hardware can prevent children from escaping a fire. A window that can't be open serves no purpose. The code should contain rules to help safeguard our children just as it has other members of society.

This should pose no hardship on window manufacturers as they are already required to produce such windows for accessibility purposes.

Cost Impact: None

RB120-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1.4-RB-DAVIDSON

RB121 – 13
R310.1.5 (New)

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

<u>**R310.1.5 Identification.** Where windows are used to meet the requirements of this section, they shall be provided with a manufacturer's designation or mark that provides one of the following:</u>

1. <u>The net clear opening area, the net clear opening height, and the net clear opening width of the window or</u>
2. <u>Shall be identified as meeting emergency escape and rescue requirements with a manufacturer's designation or mark that reads "Emergency Escape and Rescue Opening 5.0 sq. ft" or Emergency Escape and Rescue Opening 5.7 sq. ft." as applicable or similar language to indicate that the window meets the requirements of this section.</u>

<u>The manufacturer's designation or mark shall be affixed to the window so as to be visible for inspection and shall be of a type which once applied cannot be removed without being destroyed.</u>

Reason: This proposal was submitted for the hearings in Baltimore. Prior to the proposal being heard, I was approached by representatives of several window manufacturers' about modifications to the proposal and a promise from them to work with me if I would request the proposal be disapproved. I made the request that the proposal be disapproved and the committee did so. That is a matter of public record.

Unfortunately, this appears to have been a delay tactic by the window manufacturers. There were never any offers of alternative language. It was suggested that perhaps inspectors should carry premeasured sticks or templates to determine compliance. Then, opponents of the proposal suggested that I requested the committee overturn the proposal to avoid any discussion before the committee! This is underhanded and deceitful.

The proposal is being brought back before the committee.

Several window manufacturers' already label their windows as meeting code requirements. Examples of the labeling follow. Requiring all window manufacturers' to label their windows levels the playing field for all manufacturers. Recall that during the discussion regarding fire protection of under floor spaces that it was argued that certain materials performed better in fire situations than others and that they shouldn't warrant the additional fire protection. But several speakers stated "cover 'em all, keep the playing field level", and we did. This proposal deserves the same consideration.

Window manufacturers' already have statements in their literature that clearly indicate which of their windows meet or exceed national egress requirement. They don't need to conduct any research to comply with the rules.

Please note that the information from the manufacturers clearly states that their windows meet or exceed national egress requirements. If there truly is a concern about liability, it isn't demonstrated by the information on the manufacturer's own websites and advertising information.

The proposed amendment provides two options for identifying that the window meets egress requirements. The designation or mark may either provide the height, width, and opening dimensions or a statement that it meets either the 5.0 or 5.7 square foot opening requirements. The designation or mark is not required to be a permanent label. The label may be a paper label but must be designed so that it cannot be transferred from one window to another. This will enable the field inspector the ability to approve windows without the need to measure them with the same accuracy as the manufacturer and without the need to perform multiplication of fractional numbers in the field. The terms "manufacturer's designation" and "mark" are defined in the code. The term "once applied cannot be removed without being destroyed" is already used in the code to describe other labels, designations, or marks.

> ***MANUFACTURER'S DESIGNATION.*** *An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also "Mark" and "Label.")*
>
> ***MARK.*** *An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "Manufacturer's designation" and "Label.")*

Why can't the field inspector measure the windows in the field? If you review the hundreds of sizes and styles of windows available from dozens of manufacturers, it is apparent that there are thousands of windows that meet or come close to meeting egress requirements. You will find that some windows are exactly 5.7 square feet or 5.0 square feet. And there are others that are just a few hundredths of a square foot more or less. Herein lays the problem. Could a field inspector carry a calculator in the field and a binder of window catalogs? Of course they could. But they aren't expected to do that for other building components. What makes windows so special? Why can't the manufacturer just put a simple label on their product?

Manufacturers measure window openings to the 1/16th or to the hundredths of an inch. This degree of accuracy cannot be achieved in the field. Windows often have gaskets or weather stripping that interferes with measurements and can cause variations during very hot or very cold weather. Incorrectly measuring the window size by even a 1/16th of an inch can give the impression that a window meets or fails to meet egress requirements when the opposite is true. Validating this takes time and can lead to unnecessary expense and delays. And if one window brand is approved that is just short of meeting minimum standards, the door is open for every other window manufacturer who has a window just slightly below minimum to request the same treatment.

For example, Andersen Windows advertises that their CW135 casement window has a clear opening of 22-9/16 inch by 36-3/8 inch. They state the net clear openable area is 5.7 square feet. Multiplying the width times the height (try doing that in your head) actually gives an area of 5.69938151 square feet. Setting aside the arguments related to rounding, it is easy to see that if a field inspector measured one of these windows at 22-7/16 inch by 36-1/4 inch that he would likely fail the window. This will delay the construction, increase costs, and provide no increase in safety.

♦ These units meet or exceed the following dimensions: Clear Openable Area of 5.7 sq. ft., Clear Openable Width of 20" and Clear Openable Height of 24", when appropriate hardware (straight arm or split arm) is specified.

Identifying windows as meeting egress requirements will also provide consumers, contractors, sales people and others concerned about a window used as an emergency escape and rescue opening the information they need to make informed decisions regarding the window without the need to search a catalog or website. It will also help to increase awareness of egress requirements. I'm sure every building department has stories they could tell about inspections of egress windows that failed to meet the required size and had to be removed and returned to the retailer at a loss and how the sales person either wasn't aware that egress requirements existed or didn't know the details of the rule.

Most window manufacturers *do not* provide any opening dimension information on the labeling of their windows. They are often shrink wrapped which prohibits them being measured at the store. There is no way for the purchaser of a window to know if the window meets emergency escape and rescue opening requirements. Most often, they will rely on the experience, or lack thereof, of the sales person they are dealing with. Sales people in big box home improvement stores are not trained and change frequently. Likely unintentionally, they frequently give homeowners the wrong information when purchasing windows that ends up being a costly mistake.

Casement Window Opening Specifications – Continued

Unit Number	Clear Opening Straight Arm		Clear Opening Split Arm		Clear Opening in Full Open Position: Straight Arm Width		Clear Opening in Full Open Position: Split Arm Width		Clear Opening in Full Open Position: Height		Glass		Crack Opening Vent Sash Only		Straight Arm Vent		Split Arm Vent		Top of Subfloor to Top of Inside Sill Stop		Overall Unit Area	
	Sq. Ft.	(m^2)	Sq. Ft.	(m^2)	Inches	(mm)	Inches	(mm)	Inches	(mm)	Sq. Ft.	(m^2)	Lineal Ft.	(mm)	Sq. Ft.	(m^2)	Sq. Ft.	(m^2)	Inches	(mm)	Sq. Ft.	(m^2)
CW12	3.0	(0.279)	2.5	(0.232)	22 9/16"	(573)	18 11/16"	(475)	19 1/4"	(489)	3.2	(0.297)	8'-3 9/16"	(2529)	3.0	(0.279)	3.0	(0.279)	60 9/16"	(1538)	4.8	(0.446)
CW125	3.7	(0.344)	3.0	(0.279)	22 9/16"	(573)	18 11/16"	(475)	23 7/16"	(595)	3.9	(0.362)	8'-11 11/16"	(2726)	3.7	(0.344)	3.6	(0.334)	56 3/8"	(1432)	5.6	(0.520)
CW13	4.9	(0.455)	4.0	(0.372)	22 9/16"	(573)	18 11/16"	(475)	31 1/16"	(789)	5.2	(0.483)	10'-3 3/16"	(3129)	4.9	(0.455)	4.8	(0.446)	48 3/4"	(1238)	7.1	(0.660)
CW135♦	5.7	(0.530)	5.1	(0.474)	22 9/16"	(573)	20"	(508)	36 3/8"	(924)	6.0	(0.557)	11'-0 15/16"	(3377)	5.7	(0.530)	5.5	(0.511)	43 7/8"	(1114)	8.0	(0.743)

At the hearings in Dallas, one window rep stated that most window buyers will have researched this information and know what size window they want before they ever get to the retailer. This is pure unfounded speculation. This presumes that untrained homeowners and others will be able to wade through the manufacturer's literature, know what the rules are, and how those rules apply to one of a myriad of window sizes. In the *real* world, this just doesn't happen. Window manufacturers do not work with homeowners and contractors on a daily basis. Building departments do.

Once a window is installed that is too small, it is expensive to replace and creates unnecessary conflict between the homeowner and building department.

The information that would go on the label is already in the manufacture's printed literature. It doesn't require the manufacturer to generate new information. The manufacturer need not indicate that the window complies with egress requirements if they so choose even though their catalogs may already state that certain windows meet national egress requirements. It just won't get accepted.

The code requires labels on windows for energy code compliance and compliance with safety glazing. Almost every building product used today is identified with labels, designations or marks in one way or another. Windows used for egress purposes should be no different.

What is so difficult about putting a small paper label on a window to identify if it meets opening requirements for emergencies? Nothing! Window manufacturers have objected to window fall protection requirements, flashing requirements, egress window tradeoffs for sprinkler systems, labeling requirements, and on and on. The committee needs to realize that the window industry opposes any attempt to regulate it and needs to take a hard line with respect to ignoring the needs of the public.

This proposal just asks that the information already provided in the sales brochure be transferred to the window so the purchaser of the window can make an informed decision.


ARGON
EGRESS
WILL MEET 5.7
SQUARE FOOT OPENING
TO REMOVE LABEL, SIMPLY
APPLY WATER & WASH AWAY
01/28/2010


EGRESS
WILL MEET 5.7
SQUARE FOOT OPENING
TO REMOVE LABEL, SIMPLY
APPLY WATER & WASH AWAY
01/28/2010

Cost Impact: None

RB121-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1.5 (NEW)-RB-DAVIDSON

RB122 – 13
R310.1.5 (New)

Proponent: Jeff Inks, Window and Door Manufacturers Association, representing the Window & Door Manufacturers Association.

Add new text as follows:

R310.1.5 Replacement windows. Replacement windows installed in buildings meeting the scope of this code shall be exempt from the maximum sill height requirements of Sections R310.1 and Sections R310.1.1, R310.1.2, and R310.1.3 provided the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement window is not part of a change of occupancy.

Reason: First, while this provision is applicable to existing construction (for the reasons stated below), it is being proposed for inclusion in the main body of the IRC because window replacements are more common than other significant changes made to existing one- or two-family homes and townhomes, and in addition, for consistency with what is being proposed for IRC Appendix J and IEBC Chap 7 by us and the ICC CTC.

The proposed provisions and language are also based on Minnesota's residential code which does effectively incorporate the provisions into the main body of the code in the same location (R310.1.5) being proposed above.

The provisions and language have also already been approved for IEBC Chap. 4 which occurred during the Group A proceedings.

Most importantly, it's important to note that the provisions do not allow for any decrease in safety and rather will help ensure improvements in safety can be made.

More specifically, the intent of this proposal is to ensure that the IRC does not discourage or prevent improvements in emergency escape and rescue openings, especially for fire safety, in older residential occupancies by requiring replacement windows to meet all of the provisions of Section 310 when doing so can only be accomplished by increasing the size of the rough opening or altering the interior wall.

Because many of these older buildings were constructed under codes that did not include the same emergency escape and rescue opening provisions that the IRC now requires for new construction, the only way to fully meet all of the requirements of Section 310 for new construction if required when windows are replaced is to enlarge the rough opening and/or make significant alterations to the interior wall in order to accommodate any increase in window size or lowering of a sill.

At the very least, the significant cost and design challenges of altering the rough opening and/or interior wall can discourage or prevent window replacement and at worst can discourage or prevent the replacement of older windows that are harder to operate or are inoperable all together because of their age or poor maintenance and, that are significantly less energy efficient. When that happens, improvements to safety as well as energy efficiency are needlessly compromised.

Furthermore and on the whole, while some bedroom windows in older homes may not provide the full clear opening that is required for new construction or may have a sill height above 44 inches, they nonetheless still provide a viable emergency and escape rescue opening which is the primary intent of the code. Replacement of these windows with the same type of operating window or other type that can provide an equal or greater clear opening than the existing window -- even if they do not fully meet the clear opening or sill height requirements of Section 310 – is always an improvement in safety, especially when a replacement opening can provide a larger clear opening than the existing window. Such improvements in safety should not be discouraged or prevented by overly onerous requirements for replacement windows.

This proposal will help ensure that doesn't happen by providing limited exceptions to the requirements of Section 310 that can only be applied when certain conditions are met and that as already noted, will not result in a decrease in safety.

The requirements for new construction that emergency escape and rescue openings be provided as well as the operational requirements of Section 310.1.4 are maintained and still applicable to replacement windows.

Cost Impact: This code change will not increase the cost of construction.

RB122-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1.5 (NEW) #1-RB-INKS

RB123 – 13
310.1.5 (New)

Proponent: Jeff Inks, Window and Door Manufacturers Association, representing the Window & Door Manufacturers Association.

Add new text as follows:

R310.1.5 Window opening control devices. Window opening control devices complying with ASTM F 2090 shall be permitted for use on windows serving as a required *emergency escape and rescue opening.*

Reason: It has been brought to our attention that the IRC needs further clarity regarding the permitted installation of window opening control devices (wocd's) compliant with ASTM F2090 on EERO windows. While that is clearly implied and intended by Section 312 and the purpose of F2090 is specifically for wocd's with emergency release mechanisms for use on EERO windows, providing express language under Section 310.1 will provide further clarification that the installation of F2090 compliant devices is permitted on EERO windows.

Cost Impact: The code change proposal will not increase the cost of construction.

RB123-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.1.5 (NEW) #2-RB-INKS

RB124 – 13
R310.6 (New), R310.7 (New)

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R310.6 Dwelling additions. Where dwelling additions occur that contain sleeping rooms, an emergency escape and rescue opening shall be provided in each new sleeping room. Where dwelling additions occur that have basements, an emergency escape and rescue opening shall be provided in the new basement.

Exceptions:

1. An emergency escape and rescue opening is not required in a new basement that contains a sleeping room with an emergency escape and rescue opening.
2. An emergency escape and rescue opening is not required in a new basement where there is an emergency escape and rescue opening in an existing basement that is accessible from the new basement.

R310.7 Alterations or repairs of existing basements. An emergency escape and rescue opening is not required where existing basements undergo alterations or repairs.
Exception: New sleeping rooms created in an existing basement shall be provided with emergency escape and rescue openings in accordance with R310.1.

Reason: There continues to be confusion in the code enforcement community as to the requirements for emergency escape and rescue opening requirements as they apply to existing basements and additions. Hopefully this proposal will make it clearer that emergency escape and rescue openings are only required in additions if there are sleeping rooms and/or a basement and then only if the new basement does not have a sleeping room or access to an emergency escape and rescue opening in the existing basement. Furthermore, this amendment is intended to clarify that existing basements that do not undergo expansion and where no sleeping rooms are added need not have emergency escape and rescue openings installed when remodeling occurs. At least in our area, code officials sometimes require emergency escape and rescue openings be installed when basements are finished or remodeled even when no sleeping rooms occur. This was never the intent of the code.

Cost Impact: None

RB124-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R310.6 (NEW)-RB-DAVIDSON

RB125 – 13
R311.1

Proponent: Paul Armstrong, PE, CBO; Orange Empire Chapter – Code Committee; Orange Empire Chapter

Revise as follows:

R311.1 Means of egress. All dwellings shall be provided with a means of egress as provided in this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the dwelling to the ~~exterior of the dwelling at the~~ required egress door without requiring travel through a garage. <u>The required egress door shall open to a yard or court that leads to a public way.</u>

Reason: The purpose of this change is to clarify the means of egress from dwellings under the IRC. The proposal attempts to split the egress path into two simpler sentences. The original sentence has been revised to address interior path of egress travel up to the required egress door. The new sentence addresses the exterior area from the required egress door and also clarifies that the required egress door opens to a yard or court that leads to a public way. The new text is consistent with the requirement for emergency escape and rescue openings in Section R310.1.

Cost Impact: The code change proposal will not increase the cost of construction.

RB125-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.1-RB-ARMSTRONG

RB126 – 13
R311.3.2

Proponent: Wesley Walters, Clark County Nevada Development Services, representing self

Revise as follows:

R311.3.2 Floor elevations for other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than 7 ¾ inches (196 mm) below the top of the threshold.

> **Exception:** A <u>top</u> landing is not required where a stairway of two or fewer risers is located on the exterior side of the door, provided the door does not swing over the stairway.

Reason: The code does not define which landing is not required, this will clarify that it is only the top one being eliminated.

Cost Impact: The code change proposal will not increase the cost of construction.

RB126-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.3.2-RB-WALTERS

RB127 – 13
R311.4

Proponent: Homer Maiel, PE, CBO, 4LEAF, Inc., representing self

Revise as follows:

R311.4 Vertical egress. Egress from habitable levels including habitable attics and basements not provided with an egress door in accordance with Section R311.2 shall be by ~~a~~ one or more ramps in accordance with Section R311.8 or ~~a~~ one or more stairways in accordance with Section R311.7 or both. For habitable levels or basements located more than one story above or more than one story below an egress door, the maximum travel distance from any occupied point to a stairway or ramp that provides egress from such habitable level or basement, shall not exceed 50 feet (15 240 mm).

Reason: In the legacy codes, one exit from the third floor within an individual dwelling unit or a Group R, Division 3 congregate residence was allowed as long as the third story area did not exceed 500 square feet. Currently, IRC has no limitations on the stories above the second floor. This addition that limits the travel distance on the floors above the second floor to 50 feet or less addresses that concern. Same applies when there are more than one level of basement below the first floor.

Cost Impact: The code change proposal will not increase the cost of construction.

RB177-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.4-RB-MAIEL

RB128 – 13
R311. 6

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R311.6 Hallways. The minimum width of a hallway shall be not less than ~~3 feet (914 mm)~~ <u>32 inches (812 mm)</u>.

Reason: The International Residential Code Commentary states the following in regards to hallways:

> **R311.3 Hallways.** The minimum width of a hallway shall be not less than 3 feet (914 mm).
>
> ❖ Hallways must be a minimum of 3 feet (914 mm) wide to accommodate moving furniture into rooms off the hallway and for safe egress from the structure.

So the hallway width is necessary to accommodate moving furniture and for safe egress. Why should the code be concerned about moving furniture? In fact the scoping and purpose of the code say nothing about moving furniture. And if the concern was genuine, hallways would need to be wider given the size of some furniture. Clearly, the width of a hallway is an arbitrary dimension not based on safety but likely based on convenience.

Regarding safe egress, if this were truly a concern about safe egress, why wouldn't we specify the minimum door sizes from bedrooms, bathrooms, and other occupied spaces? As it is, the only thing we have to hang out hats on is the 20 inch minimum openable width of an emergency escape and rescue opening.

This is one of those code requirements that people seem to think is necessary but when push comes to shove, it doesn't get enforced.

For example, a plan review is done on a new home and the hallway is noted to be 36 inches wide. The framer then either frames the hallway at 36 inches or works from the exterior walls in to frame the various rooms. In either case, the potential exists that the hallway may be something less than 36 inches. This isn't something that many field inspectors will check at the framing inspection. Then during the final inspection the hall is determined to be 35 inches wide. What do you do? You ignore it of course. The cost to correct it is much too high given the benefit.

In another example, we have a home built with an unfinished basement. There is a center bearing wall with the furnace located a short distance from the wall. The mechanical contractor does not check the distance from the furnace to the bearing wall when installing the furnace. The basement is unfinished so the field inspector doesn't anticipate future finishing problems. Then, when the homeowner finishes the basement, the location of the furnace results in a hallway that is only 32 inches wide. They can't move the bearing wall. The cost to move the furnace and alter the ductwork, gas piping, and wiring is expensive. And what is to be gained? If the building department denies the permit, the basement will be finished at some point without permits. Do we want to encourage this?

These circumstances do occur. They are dealt with by building departments all the time. It is necessary to provide a better and more reasonable solution for this problem.

Furthermore, this will be regulated by the market place in new construction. If a homeowner views a new home for sale and they wish the hallway to be wider, they can make the decision to buy or not to buy.

The basic stair width requirement is 36 inches. But that can be reduced by 4.5 inches on each side for handrails. And the code only requires that the width of stairways below the handrails be 27 inches. Spiral stairways are permitted to be 26 inches.

R311.7 Stairways.

R311.7.1 Width. Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31^{1}/2 inches (787 mm) where a handrail is installed on one side and *27 inches (698 mm) where handrails are provided on both sides.*

Exception: The width of spiral stairways shall be in accordance with Section R311.7.9.1.

R311.7.10.1 Spiral stairways. Spiral stairways are permitted, provided the minimum clear width at and below the handrail shall be ***26 inches*** (660 mm) with each tread having a 71/2-inch (190 mm) minimum tread depth at 12 inches (914 mm) from the narrower edge. All treads shall be identical, and the rise shall be no more than 91/2 inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

The only required egress door, need only provide 32 inches of clear width. A 36 inch wide hallway seems to be an anomaly.

R311.2 Egress door. At least one egress door shall be provided for each *dwelling* unit. The egress door shall be side hinged, and shall provide a minimum clear width of 32 inches (813 mm) when measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad).

This proposal reduces the required hallway width to 32 inches consistent with the main egress door and wider than what is required for stairs. If 27 inches is safe for egress in a stair and if I can move furniture up and down a stair that is 27 inches wide, I should be able to do the same in a hall.

Cost Impact: None

RB128-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.6-RB-DAVIDSON

RB129 – 13
R311.7

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Add new text as follows:

R311.7 Stairways. Stairways serving a dwelling or accessory structure shall comply with this section. This shall include, but shall not be limited to, exterior stairs from a dwelling or garage to grade and those stairs serving decks, porches, balconies, sun rooms, and similar structures.

Exceptions:

1. Stairs serving attics or crawl spaces.
2. Stairs that only provide access to plumbing, mechanical, or electrical equipment.
3. Stairs that serve structures or spaces used by children as play areas.

Reason: When reading Section R311 of the IRC regarding stairs, the language supports only two interpretations on how stairs are regulated. Those two interpretations are that either all stairs must comply with the section or only those stairs that are a part of the means of egress should comply. There is no other language that allows vacillation between those interpretations.

The title of the section is "Means of Egress". R311.1 requires a means of egress from "all portions of the dwelling to the exterior of the dwelling…" R311.4 qualifies the charging language by stating that every habitable level including basements must either have an exterior exit door meeting the requirements of R311.2 or have a stair or ramp connecting that level to a level that has such a door. Note that it does not say "stairs" or "ramps" but "stair" or "ramp" (singular).

The text of the code does not support regulating stairs that are not a part of the "means of egress". This theory is apparently wide spread because many building officials are of the opinion that stairs used in landscaping are not regulated. Also, attempts to submit code changes to the ICC IRC Committee to give relief for stairs to attics and crawl spaces have been met with resistance from the Committee with the statement that they are already exempt. One can come to that conclusion only if you interpret the stair rules to apply to the means of egress and only one means of egress is required and that is only required from the dwelling, not attics, crawl spaces, and garages.

But if you take the position that the section only regulates those stairs that are part of the means of egress, stairways serving attics and crawl space and landscaping stairs would not be regulated but also stairs serving decks and the stairs commonly found serving as a path of travel from a dwelling to a garage would not be. In fact, R311.1 specifically prohibits a means of egress from traveling through a garage.

So there is confusion as to whether or not the code does regulate or intends to regulate certain stairs. This proposal makes it clear that all stairs are required to comply with the code unless specifically exempted. If this proposal is supported, stairs that are part of landscaping would be exempt unless they serve as a means of travel from a dwelling or accessory structure to grade. Stairs from a deck or from one level of a deck to another would be regulated. Stairs between a dwelling and garage would be regulated. Stairs serving an attic or crawl space would not be regulated. The current text already exempts stairs to crawl spaces by Section R311.4 but not directly. It exempts them because it does not list crawl spaces as a location where compliant stairs are required. But this also supports the possibility that the code does not regulate stairs serving a deck.

It is necessary to eliminate the confusion and inconsistency that exists in the enforcement of stair requirements that this language be approved. The proposal is reasonable because it puts into written format what is commonly accepted to be code language even if it cannot be supported by that text.

The following is for informational purposes only.

SECTION R311
MEANS OF EGRESS

R311.1 Means of egress. All *dwellings* shall be provided with a means of egress as provided in this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* to the exterior of the *dwelling* at the required egress door without requiring travel through a garage.

And,

R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* not provided with an egress door in accordance with Section R311.2 shall be by a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7.

Cost Impact: None

RB129-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7-RB-DAVIDSON

RB130 – 13
R311.7.1

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.1 Width. *Stairways* shall not be less than 36 inches (914 mm) in clear width at all points above the permitted *handrail* height and below the required headroom height. *Handrails* shall not project more than ~~4.5~~ 6.5 inches (~~114~~165 mm) on either side of the *stairway* and the minimum clear width of the *stairway* at and below the *handrail* height, including treads and landings, shall not be less than 31½ inches (787 mm) where a *handrail* is installed on one side and 27 inches (698 mm) where *handrails* are provided on both sides.

Exception: The width of spiral *stairways* shall be in accordance with Section R311.7.10.1.

Reason: The required continuous handrail often needs to project an additional 2 inches from the side of the stairway to maintain the required finger clearance when passing nosing projections at a floor, landing, or return flight. This would not diminish the required width and would provide needed finger clearance to avoid nosing projections into the stairway.

Cost Impact: This code change will not increase the cost of construction

RB130-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311,7.1-RB-COOPER

RB131 – 13
R311.7.2, R311.7.5.1, R311.7.5.2.1.

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

~~**Exception:**~~ **Exceptions:**

1. Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom a maximum of 4¾ inches (121 mm).
2. The headroom for spiral stairways shall be in accordance with Section R311.7.10.1

R311.7.5.1 Risers. The maximum riser height shall be 73/4 inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. Open risers are permitted provided that the opening between treads does not permit the passage of a 4-inch-diameter (102 mm) sphere.

~~**Exception:**~~ **Exceptions:**

1. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.
2. The opening between adjacent treads is not limited on spiral stairways.
3. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1

R311.7.5.2.1 Winder treads. Winder treads shall have a minimum tread depth of 10 inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a minimum tread depth of 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than 3/8 inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and do not have to be within 3/8 inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth of spiral stair stairways shall be in accordance with Section R311.7.10.1

Reason: Exception 2 **Headroom** - The user of the code is currently only directed to R311.7.10.1 Spiral Stairways under R311.7.1 Width. Specific cross reference is needed under Headroom.

Exception 1 **Risers** – No change except numbering

Exception 2 **Risers** - Conformance with the IBC allowing open risers on spiral stairways.

Exception 3 **Risers** and new exception to **Winder treads** - The user of the code is currently only directed to R311.7.10.1 Spiral Stairways under R311.7.1 Width. Specific cross reference is needed under risers and winder treads.

Cost Impact: This code change will not increase the cost of construction

RB131-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.2-RB-COOPER

RB132– 13
R311.7.3

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.3 Vertical rise. A *flight* of *stairs* shall not have a vertical rise greater than ~~12 feet (3658 mm)~~ <u>147 inches (3734 mm)</u> between floor levels or landings.

Reason: The elevation of 147 inches is a multiple of the maximum riser height of 7-3/4 inches (197 mm). (See Table 1) This minor change of just 3 inches (76 mm) in the total rise of the flight would in many cases eliminate the cost of incorporating a landing and the space required, reducing construction costs. As can be seen in the table below this change would require no additional steps in the stair than the current code requires and a change in riser height of just 5/32 inch (4 mm) or less when the minimum number of risers is desired. This represents no discernable difference consequential to the user.

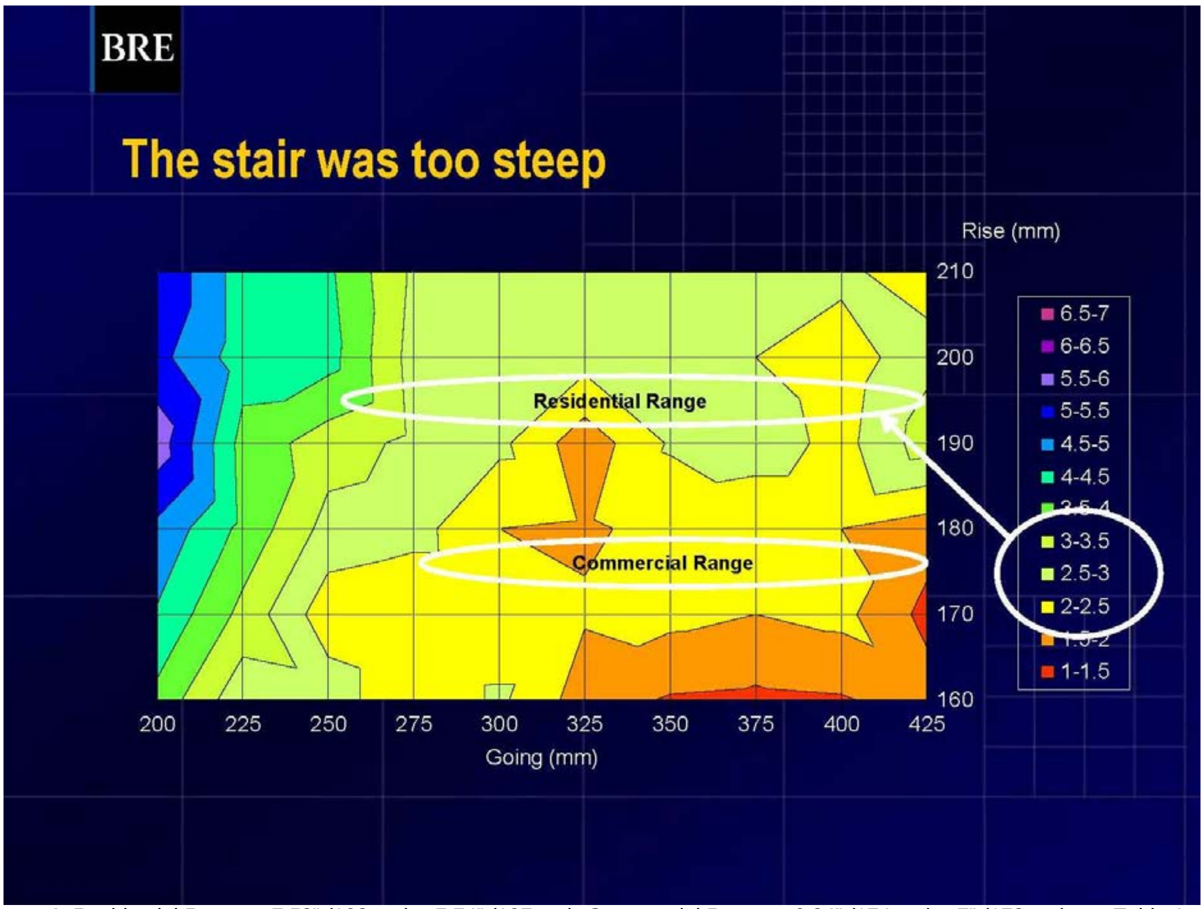


Figure 1 Residential Range = 7.58" (193mm) – 7.74" (197mm), Commercial Range = 6.84" (174mm) – 7" (178mm) see Table 1
Please note that the described circled ranges have been added to figures 1&2 by the proponent for the purpose of explanation.

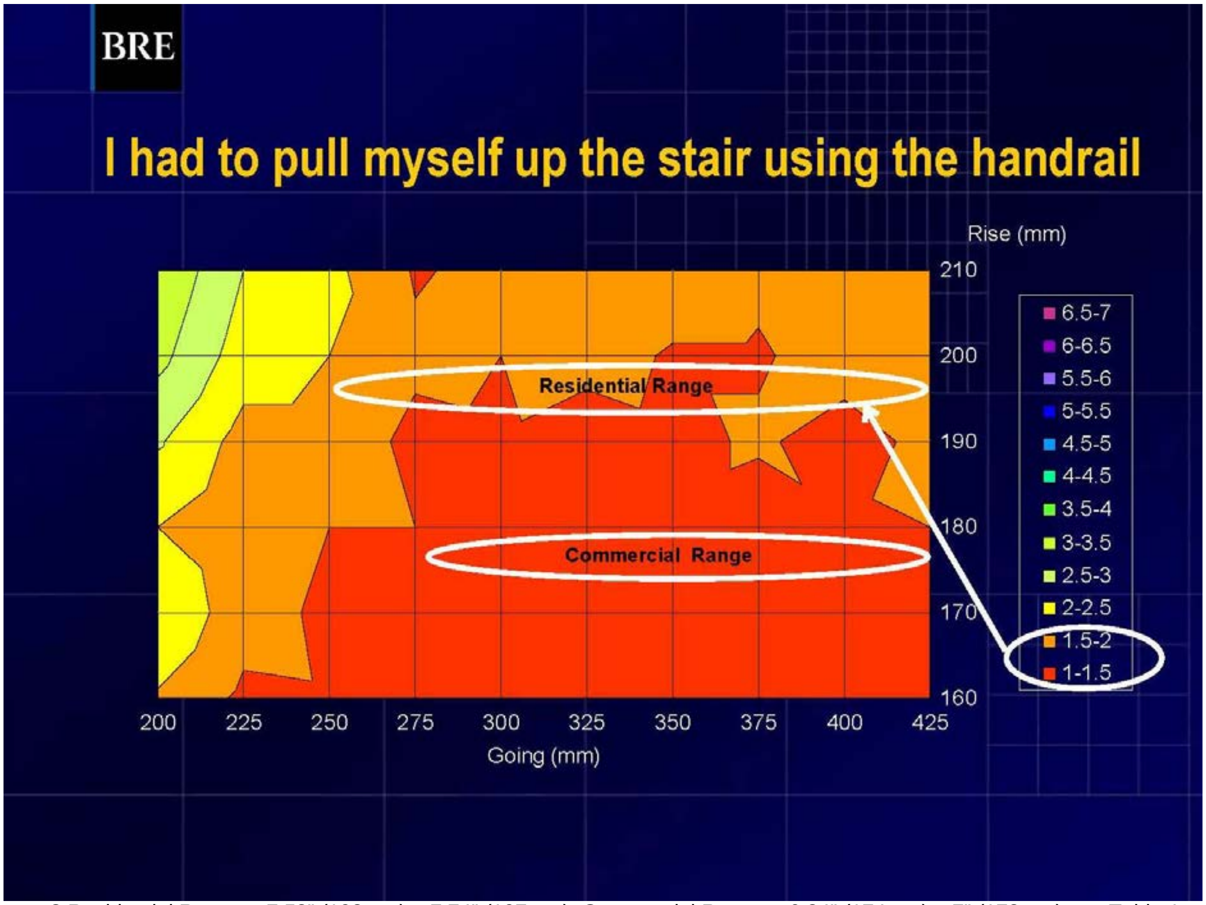


Figure 2 Residential Range = 7.58" (193mm) – 7.74" (197mm), Commercial Range = 6.84" (174mm) – 7" (178mm) see Table 1
Please note that the described circled ranges have been added to figures 1&2 by the proponent for the purpose of explanation.

	Vertical Rise	# Risers	Riser Height Inches	Change in Riser Height inches	Riser Height mm	Change in Riser Height mm
Most Occupancies	144	21	6.86		174	
	147	21	7.00	0.14	178	4
Dwelling Units	144	19	7.58		193	
	147	19	7.74	0.16	197	4

Table 1

Testing in support of this proposal, as shown in the data presentations (Figure 1 and 2) from; "The Influence of Rise and Going Combinations on Stair Safety" by M S Roys, June 2004, 7th World Conference on Injury Prevention and Safety Promotion, Vienna[1], the minor variation in rise does not produce any consequential effect that can be noticed by users when comparing riser heights within the range in question. *Please note that the circled ranges have been added to figure 1 & 2 by the proponent for the purpose of explanation*. Figures one and two can be related to the perceived energy required in ascent as described by the subjective rating of the steepness of the stair and the need to pull oneself up the stair using the handrail. In these figures the user's ratings are on a scale of 1-7 and color coded. The visual display of the data shows little difference in the users ratings over the range in question.

Additional testing data from this same study further illustrates little difference in the user's perception of riser height. When asked to rate descent of the stairway in response to the statement "I felt safe when walking down the stair" the risers heights of 6.69 inches, 7.09 inches, 7.48 inches (170 mm, 180 mm, 190 mm) all were rated the same with a tread depth of 10.83 inches (275 mm). Compared with the same tread depth the riser heights of 7.87 inches, 6.30 inches (200 mm, 160 mm) were within approximately 0.5 points on a scale of 7 points further indicating little difference being perceived by the users. This provides further validation that the change proposed is reasonable and will not affect stair safety.

Construction cost reduction – It is common for the total rise to exceed 144 inches (3658 mm) with oversight of the requirement or minor changes in floor systems and finish flooring options. In particular new floor truss systems and engineered joist materials increase floor thickness and story height especially when added to older designs. This requires the addition of an intermediate landing. Adding a landing increases the footprint of the stairway and the cost if the space is available.

Understanding and Compliance – This change will not increase the number of risers needed in the stairway or make the stairway less safe, or add any significant or perceived increase in energy to climb the stairway. This needed change provides a direct relationship between the vertical rise requirement and the requirements for riser height that would assure better understanding and compliance.

Bibliography:

1. "The influence of rise and going combinations on stair safety"; M.S. Roys, 7th World Conference on Injury Prevention and Safety Promotion, Vienna, June 2004

Cost Impact: This will reduce the cost of construction.

RB132-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.3-RB-COOPER

RB133 – 13
R311.7.5.1

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.5.1 Risers. The maximum riser height shall be 7¾ inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any *flight* of *stairs* shall not exceed the smallest by more than ⅜ inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. Open risers are permitted provided that ~~the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.~~ <u>riser openings between treads located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the lower edge of the riser do not permit the passage of a 4 inch diameter (102 mm) sphere.</u>

> ~~**Exception:** The opening between adjacent treads is not limited on stairs with total rise of 30 inches (762 mm) or less.~~

Reason: The exception allows unrestricted openings in risers if the stair has a 30" total rise. This is a flawed requirement. Flights stacked in a well could have a total rise of 30 inches and an exposure to a much greater fall distance to the next level or flight below. This change correctly identifies the hazard and the needed requirement applies the language found in section R312, Guard and window fall protection.

Cost Impact: This code change would not increase the cost of construction.

RB133-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.5.1-RB-COOPER

RB134 – 13
R311.7.5.1, R312.1.3

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R311.7.5.1 Risers. The maximum riser height shall be $7^3/4$ inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. Open risers are permitted provided that the opening between treads does not permit the passage of a ~~4-inch-diameter (102 mm) sphere~~ 6 inch diameter (153 mm) sphere.

> **Exception:** The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

R312.1.3 Opening limitations. Required *guards* shall not have openings from the walking surface to the required *guard* height which allow passage of a sphere ~~4 inches (102 mm)~~ 4⅜ (111 mm) in diameter.

> ~~**Exceptions**~~ **Exception:**
>
> ~~1.~~ The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
>
> ~~2. *Guards* on the open side of stairs shall not have openings which allow passage of a sphere 4⅜ inches (111 mm) in diameter.~~

Reason: Currently the code has three different limitations on openings in guards that could occur within inches of each other. Clearly something is amiss. It is impossible to offer a rational explanation to the public why there are three different opening limitations that are all intended to prevent children from falling through them. Let's put ***some*** meaningful uniformity in the code by allowing spacing on all guards to be 4 3/8 inches and six inches when it comes to riser openings. The proposal increases the spacing on all guards to the 4 3/8 inch standard allowed on guards on stairs and increases the openings on risers to 6 inches which is the standard permitted for the triangular space formed by the riser and the tread.

Cost Impact: None

RB134-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	D

R311.7.5.1-RB-DAVIDSON

RB135 – 13
R311.7.5.3

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.5.3 Nosings. The radius of curvature at the nosing shall be no greater than 9/16 inch (14 mm). A nosing <u>projection</u> not less than ¾ inch (19 mm) but not more than 1¼ inches (32 mm) shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than ⅜ inch (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosings shall not exceed ½ inch (12.7 mm).

> **Exceptions:** A nosing <u>projection</u> is not required where the tread depth is a minimum of 11 inches (279 mm).

Reason: The addition of the word "projection" corrects and clarifies the intent of the requirement and exception.

Cost Impact: This code change does not increase the cost of construction.

RB135-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.5.3-RB-COOPER

RB136 – 13
R311.7.8.2

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

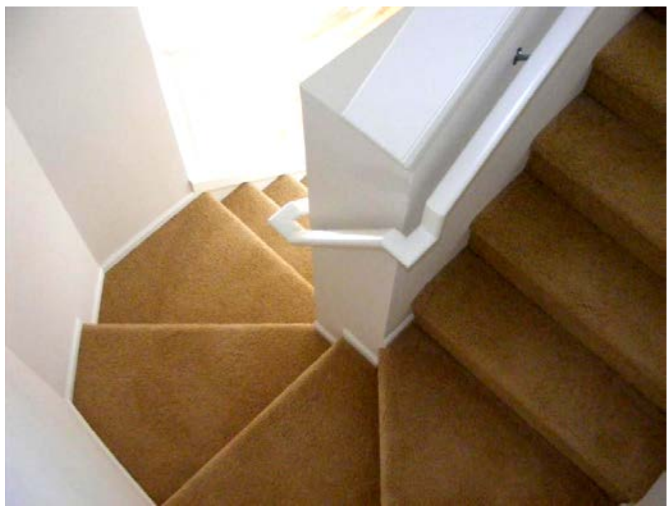
R311.7.8.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inch (38 mm) between the wall and the handrails.

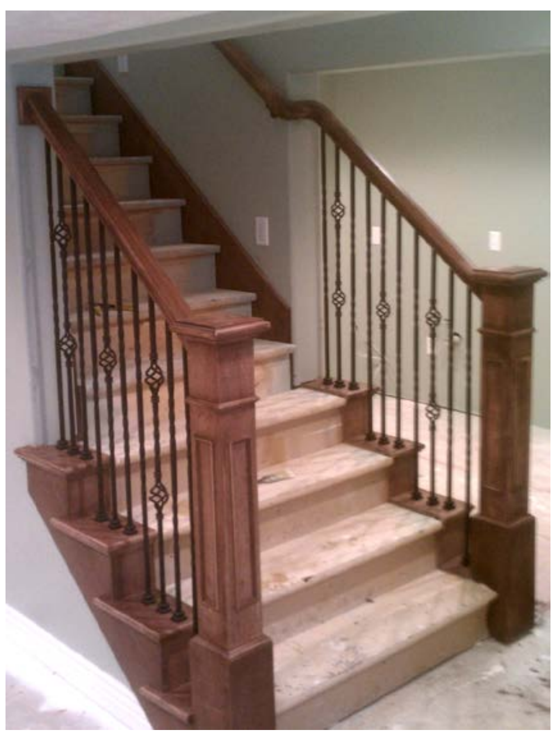
Exceptions:

1. Handrails shall be permitted to be interrupted ~~by a~~ newel posts ~~at the turn~~.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.
3. Handrails shall be permitted to be interrupted at the transition from a wall to a guard.
4. Handrails shall be permitted to be interrupted where a flight changes direction.

Reason: Handrails are required by the IRC to be continuous with two exceptions. The first allows the rail to be interrupted by a newel post "at a turn". The term "at a turn" can be interpreted in different ways. Does this mean a ninety degree turn, a 180 degree turn, or perhaps a 45 degree turn? Does it apply only when flights are interrupted by a landing or does it also apply to winder stairs? But let's face it. These rails are in dwellings, not public settings. These rails are often installed by homeowners who lack even simple joinery skills. The users of the stairs are familiar with their surroundings. The rails are not required for accessibility purposes. Yet they are required to meet the same standard that applies to high occupant load commercial applications. That is overkill.

If it is safe to remove one's hand when maneuvering around a newel post "at a turn", why is it not safe to do the same on a straight run of a stair, or when negotiating a turn on a winder stair, or when transitioning from a stair enclosed on both sides to open on both sides? Following are some attempts at compliance with current code





Does anyone really believe that the user of any of these stairs would maintain contact between their hand and the railing during the complete traverse of the stair? Likely not, because it requires twisting the wrist and hand in ways that are uncomfortable if not impossible.

Let's be realistic. For dwelling applications, it is reasonable to allow greater leeway in handrail designs. Following are some examples of railings designs that are no more hazardous than the ones deemed 100% compliant. The last example is commonly found by field inspectors on owner (and sometimes contractor) constructed deck stairs. Intermediate posts are necessary to stabilize the guard. But the post interrupts the handrail and results in a correction notice to install a continuous rail. This is usually met by complaints by the homeowner that no unsafe condition exists and many people would agree. Installing an additional railing on this type of stair "just to meet the code" smacks of over-regulation, generates complaints about the unsightly finished product, and adds unnecessary cost to the construction of the stair not to mention the ill will created between building departments and taxpaying homeowners.

It is time to add some reasonableness to the handrail requirements for dwellings. This proposal adds a number of changes. First, it allows the rail to be discontinued whenever a newel post occurs. It deletes the ambiguous term "at the turn" and allows the newel post be placed at any change of direction or at mid flight if desired. Either the interruption of a rail by a newel post is a hazard all of the time or none of the time. This proposal takes the position that a newel post poses no hazard. The second change allows the handrail to be discontinued where the stair makes a change from having walls on the side of the stair to having guards as is illustrated below. The basis for the argument is that creating a turn in the handrail that may cause the wrist to make a full ninety degree turn at this transition is not reasonable and that the average individual will take their hand off the rail anyway to make this transition. Furthermore, this situation, oft encountered when basements are finished, is difficult for most homeowners to overcome. The last change adds an exception allowing the handrail to be discontinued when the stair makes a change in direction as may occur with a winder stair. The following pictures illustrate some of those applications.

This proposal will not lessen the safety of stairs. In some cases it may enhance the safety by creating handrails that are more ergonomically useable. It will enable homeowners to comply with the rules and stay within their skill levels thus keeping costs reasonable.

Cost Impact: None

RB136-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.8.2-RB-DAVIDSON

RB137 – 13
R311.7.9

Proponent: Wesley Walters, Clark County Nevada Development Services, representing self

Revise as follows:

R311.7.9 Illumination. All ~~stairs~~ stairways shall be provided with illumination in accordance with Section R303.~~6~~ 7.

Reason: Section R303.7 heading is Stairways not stairs. Stairs are a component of a stairway.

Cost Impact: The code change proposal will not increase the cost of construction.

RB137-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.9-RB-WALTERS

RB138 – 13
R311.7.10.1

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.10.1 Spiral stairways. Spiral *stairways* are permitted, provided the minimum clear width at and below the *handrail* shall be 26 inches (660 mm) ~~with~~ and the walkline radius is not greater than 24½ inches (622 mm). E~~e~~ach tread ~~having~~ shall have a minimum tread depth not less than 7½ inch (190 mm) ~~minimum~~ ~~tread depth~~ at ~~12 inches (914 mm) from the narrower edge~~ the walkline. All treads shall be identical, and the ~~rise~~ riser height shall be no more than 9½ inches (241 mm). ~~A minimum~~ ~~h~~Headroom shall be not less than 6 feet 6 inches (1982 mm~~) shall be provided~~.

Reason: The difference between Spiral Stairways and Curved Stairways is subject to interpretation. Spiral stairways provide a space saving alternative and by their nature are safely used with taller risers and treads that are narrower at the walkline. Currently spiral stairways may be of unrestricted size. This change defines a reasonable limit for the design of spiral stairways with the allowed "exceptions" for headroom, riser height and tread depth.

Stairs beyond the limit stated would be considered a curved stair. A 24½ inches maximum walkline radius dimension effectively provides a minimum radius no greater than 12½ inches at the inside of the turn. It represents that point at which the 6 inches minimum tread width of winder treads can be achieved with 13 treads in one revolution a typical and common manufacturing standard. Beyond this point curved stairways complying with **R311.7.5 Stair treads and risers** and **R311.7.2 Headroom** would be required. This change is meant to correlate with the newly proposed IRC definition of spiral stairway and eliminating the reference to a supporting column as found in the IBC.

We have also made editorial changes and substituted the code section title terms "walkline" and "riser height" to clarify and provide for more consistent interpretation.

Cost Impact: This code change will not increase the cost of construction.

RB138-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.10.1 #1-RB-COOPER

RB139 – 13
R311.7.10.1

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Revise as follows:

R311.7.10.1 Spiral stairways. Spiral *stairways* are permitted, provided the minimum clear width at and below the *handrail* shall be 26 inches (660 mm) with each tread having a ~~7½~~ 6¾ inch (~~190~~ 171 mm) minimum tread depth at 12 inches (914 mm) from the narrower edge. All treads shall be identical, and the rise shall be no more than 9½ inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

Reason: This change is largely editorial. Treads within Spiral Stairways meet the definition of winder treads and are sometimes interpreted to be measured for tread depth in the same fashion. This change simply adjusts the spiral stair tread depth in conformance with the 2009 change in the method of measuring for winder tread depth at the intersections of the walkline with the nosings instead of the prior method which was square to the leading edge. The effective tread depth remains unchanged as can be seen in figure one.

The intent of the 2009 change in measuring methods was to provide for consistent tread depth measurements conforming with stair design methodology not to change or increase tread depth.

The long accepted 7½ inches tread depth was based on the typical spiral layout with 13 treads per revolution or 27.692 degrees per tread. Figure one illustrates the 7½ inches measurement made square to the leading edge of the tread, and also shows the tread depth when measured at the intersections of the walkline and nosings. For the ease of enforcement we have rounded the required tread depth to 6¾ inches

This change is necessary to allow long accepted manufacturing, material and design standards to continue to meet the requirement and does not change the effective depth of the tread.

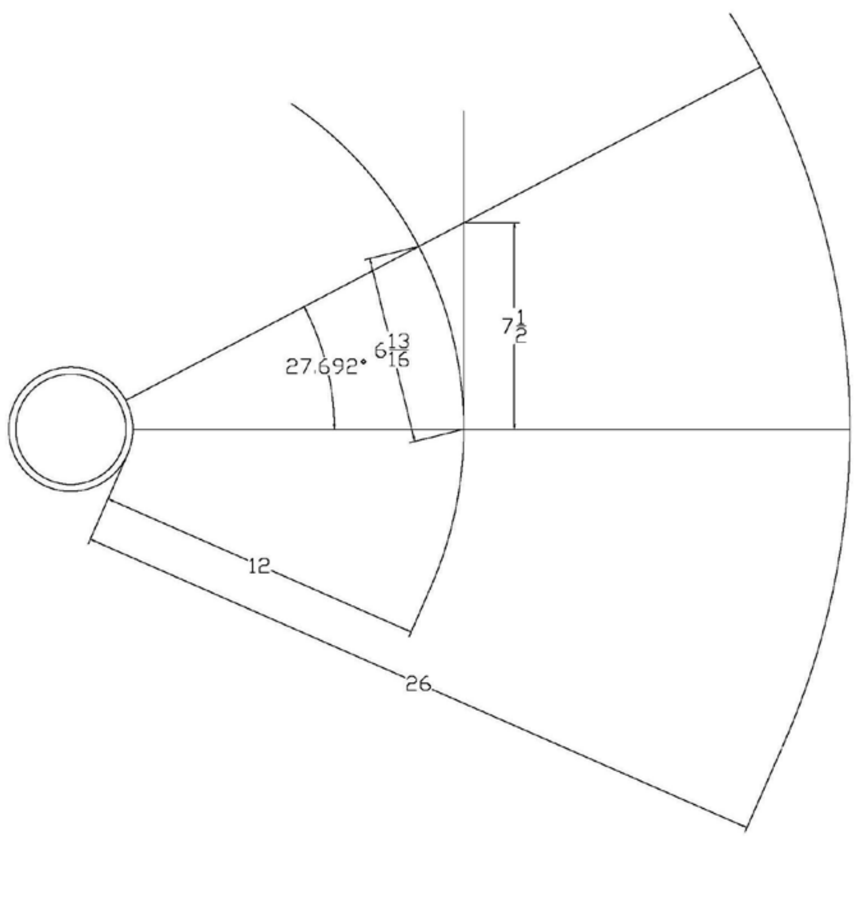


FIGURE ONE illustrates a winder tread from a typical spiral stairway with 13 treads per revolution. The dimensions shown allow comparison of the tread depth when measured square to the leading edge and when measured at the intersection of the walkline with the nosings. This simply shows that the old requirement of 7½ inches needs to change to accommodate the new measuring method cited in **R311.7.5.2.1 Winder Treads.**

Cost Impact: This change will eliminate unintended increases in the cost of construction.

RB139-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.10.1 *2-RB-COOPER

RB140 – 13
R202, R311.7.11 (New)

Proponent: David W. Cooper, Stair Manufacturing and Design Consultants, representing the Stairway Manufacturers' Association (sma@stairways.org)

Add new definition as follows:

SECTION R202
DEFINITIONS

ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

Add new text as follows:

R311.7.11 Alternating tread devices. *Alternating tread devices* shall not be used as an element of a means of egress. *Alternating tread devices* shall be permitted provided the required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).

R311.7.11.1 Treads of alternating tread devices. *Alternating tread devices* shall have a tread depth of not less than 5 inches (127 mm), a projected tread depth of not less than 8 1/2 inches (216 mm), a tread width of not less than 7 inches (178 mm) and a riser height of not more than 9 1/2 inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

R311.7.11.2 Handrails of alternating tread devices. *Handrails* shall be provided on both sides of *alternating tread devices* and shall comply with R311.7.8.2 thru R311.7.8.4. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

R311.7.12 Ship ladders. Ship ladders shall not be used as an element of a means of egress. Ship ladders shall be permitted provided a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches.

R311.7.12.1 Treads of ship ladders. Treads shall have a tread depth of not less than 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the *nosing* projection is not less than 8 1/2 inches (216 mm). The riser height shall be not more than 91/2 inches (241 mm).

R311.7.12.2 Handrails of ship ladders. *Handrails* shall be provided on both sides of ship ladders and shall comply with R311.7.8.2 thru R311.7.8.4. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

Reason: Alternating tread devices and ship ladders are used in residential applications but are not regulated. This language adopts the specifications from the IBC providing the needed guidance when they are used. This further clarifies that an Alternating Tread Device and or Ship Ladder cannot be used as an element of a means of egress, and can only be used when a means of egress is not required or when the required means of egress stairway or ramp is provided to serve the same spaces at each level.

Cost Impact: This code change will not increase the cost of construction.

RB140-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.7.11 (NEW)-RB-COOPER

RB141 – 13
R311.8.1

Proponent: Rick Davidson, City of Maple Grove Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R311.8.1 Maximum slope. Ramps <u>serving the egress door required by section R311.2</u> shall have a maximum slope of 1 unit vertical in 12 units horizontal (8.3-percent slope). <u>All other ramps shall have a maximum slope of 1 unit vertical to 8 units horizontal (12.5-percent slope).</u>

Exception: Where it is technically infeasible to comply because of site constraints, ramps may have a maximum slope of one unit vertical in eight horizontal (12.5-percent slope).

Reason: When ramp slope requirements were changed a few years back, the reason stated was to enable persons with disabilities to stay in their homes. However, the scope of the proposal included all ramps, even those that could not be used by persons with disabilities. For example, dwelling additions to older homes sometimes have new basements at a deeper level and the owner wishes to make the transition by ramp. A 1:12 slope can sometimes be difficult to achieve and absorbs much more space than need be. Media rooms are often designed to have sloping floors with ramps serving the seating and again the 1:12 slope is problematic. This proposal gives some relief for those situations where accessibility may not be an issue. This also is consistent with section 1010.3 of the IBC which allows a 1:8 slope for pedestrian ramps not used as a means of egress.

IBC
SECTION 1010
RAMPS

1010.3 Slope. *Ramps* used as part of a *means of egress* shall have a running slope not steeper than one unit vertical in 12 units horizontal (8-percent slope). The slope of other pedestrian *ramps* shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope).

Cost Impact: None

RB141-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.8.1-RB-DAVIDSON

RB142 – 13
R311.8.1, R311.8.2

Proponent: Glenn Mathewson, MCP., representing self (GlennMathewson@nadra.org)

Revise as follows:

R311.8.1 Maximum slope. Ramps shall have a maximum slope of 1 unit vertical in 12 units horizontal (8.3-percent slope).

> **Exception:** Where it is technically infeasible to comply because of site constraints, ramps shall ~~may~~ have a maximum slope of ~~one~~ 1 unit vertical in ~~eight~~ 8 units horizontal (12.5-percent slope).

R311.8.2 Landings required. There shall be a floor or landing at the top and bottom of each ramp, where doors open onto ramps, and where ramps change directions. The width of the landing perpendicular to the ramp slope shall be not less than the width of the ramp. The depth of the landing in the direction of the ramp slope shall be not less than 36-inches. ~~A minimum 3-foot-by-3-foot (914 mm by 914 mm) landing shall be provided:~~

1. ~~At the top and bottoms of ramps.~~
2. ~~Where doors open onto ramps.~~
3. ~~Where ramps change directions.~~

Reason:-It is inconsistent to present slope in one section using numerical symbols, and then in the exception use textual language. It appears to be more common in the IRC to use numerical symbols, thus the choice to modify the exception.
-Use of the word "may" is in appropriate when referring to a maximum value. "Shall" is clearer that the maximum value is the undisputable limit.
All other landings in the IRC (doors/stairs) reference the width of the feature they serve, as this is sensible. Currently ramp provisions refer to a specific geometric width, and would not properly and safely accommodate a ramp that was wider than the minimum 36 inches. Likely…landings are already built to the width of the ramps they serve.
-The use of a list of landing locations is not consistent with other similar IRC sections. The proposed language is more similar to that used to describe landings on stairs…a very similar feature.

Cost Impact: The code change proposal will not increase the cost of construction.

RB142-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R311.8.1-RB-MATHEWSON

RB143 – 13
R312.1.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R312.1.1 Where required. *Guards* shall be located along ~~open-sided walking surfaces, including~~ the open sides of floors, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or *grade* below ~~at any point within 36 inches (914 mm) horizontally to the edge of the open side~~. Insect screening shall not be considered as a *guard*.

Reason: The first portion of the proposal deletes the requirement that guards be located along open sided walking surfaces and replaces it with the same language found in the previous IRC. This is necessary because the term "open sided walking surfaces" is so broad in scope that it could be and is being applied to almost any surface on or in a building or a lot. It could be interpreted to require guards being installed around window wells, on the top of retaining walls, along driveways and sidewalks, on landings near window wells, at the edge of swimming pools, and even at the edge of flat roofs. The definitions for floors, stairs, ramps, and landings are well established. Everyone understands the application with these terms. It is reasonable to use terms that are understandable to all.

The second part of the proposal deletes the reference to measuring the height of the walking surface three feet from the edge of the walking surface and returns it to the language that existed in the IRC since its inception and in the previous model codes for decades.

It seems to be a widely held belief that the Uniform Building Code required that a measurement from floor to grade be taken at a point five feet from the floor to determine if a guard was required.

But, the Uniform Building Code never said that is how the distance should be measured nor did the BOCA National Building Code or the Southern Building Code. They all stated that the 30 inch height (15 ½ inches in the National Building Code and 30 inches in the Southern Building Code) be measured to the floor or grade below or very similar language.

Then where did the five foot measuring requirement come from? It came from the definition of "grade". For years, ICBO staff taught that the use of the term "grade" in the phrase "30 inches above floor or grade below" was defined and that the definition in the UBC required that grade be measured five feet from the building or if the property line was less than five feet from the building then it would be measured from a point between the building and the property line.

This creates at least two inconsistencies if the argument was that the five foot distance was safety oriented. First, you only measured five feet over if what was below the walking surface was "grade". If it were a floor, you just measured straight down. Second, if the building was near a property line, you only measured to the property line even if there were a severe drop at the property line. Theoretically under the UBC, one could have a walking surface that was adjacent to a property line with a 30 foot drop at the property line and no guard.

The idea that one should measure the 30 inch distance at some point other than the base of the walking surface was strictly an ICBO opinion and not binding on any building official. Based on the inconsistencies cited, there is certainly room for other opinions. Because a portion of the language in the UBC definition that stated that grade was between the building and the property line did not make it into the IRC, the IRC version requires that the measurement extend to adjoining lots in some cases.

But there is more.

The BOCA National Building Code required guards be provided when the walking surface was more than 15 ½ inches above the floor or grade below. But the BOCA code did not define "grade", only "grade plane". And the definition of "grade plane" was used exclusively to determine the reference point for the height and number of stories of a building for purposes of determining compliance with height and number of stories limitations based on use and type of construction. It is not known how BOCA staff taught how to measure for guards but the language in the BOCA code is the same as it has been in the IRC since its inception.

The Southern Building Code provided a definition for "grade" but the method of measuring the height of a floor surface was stated to be "30 inches above ***finished ground level*** or a floor below". While grade required measuring a distance of six feet away, that term was not used in defining when a guard was required. It is not known how SBCCI staff taught how to measure guards but it doesn't appear the Southern Building Code provided any means to take the measurement at any location but straight down from the edge of the walking surface.

More about the UBC. Was it really intended that the measurement requiring guards be taken five feet from the walking surface or was that just happenstance and poor choices of terms in the code sections?

I would argue that it was never intended that the method used to determine whether or not a guard was required be five feet from the walking surface. Besides the inconsistencies above, the UBC definition of "grade" states that it is the distance "between the ***building*** and the property line". The term "building" does not appear to mean a floor or walking surface that could be used to determine guard requirements.

And then there is more. The UBC contained references to measuring grade at a distance away from the building dating back at least into the 1930's. Apparently the game of piling dirt next to a building to reduce the height or number of stories is not new. Grade was always about height and number of stories of the building, not as a means to require a guard.

An explanation of the term "grade" from the "*Design Guide – 1988 UBC*" by Alfred Goldberg is provided below. Mr. Goldberg states that the "determination of the grade level is important to the designer for several reasons, including the qualification of a level as a basement and the measurement of the allowable overall height of the building." Mr. Goldberg goes on to explain the nuances of application of the term "grade" and cautions on the "repercussions" of errors in applying the rules. Not once in Mr. Goldberg's book does he reference that "grade" has anything to do with guards.

In the "*Handbook to the Uniform Building Code, An Illustrative Commentary*" published by ICBO, the statement is made in regards to "grade" that "This definition is important in determining the number of stories within a building as well as its height in feet." There is also a discussion on the issue of guards but never once is there a reference to how one determines whether a guard is required. One would think it is important to create the link because the section regarding guards only states measuring to the floor or grade below.

That brings us to today. Given that the Southern Building Code, the National Building Code, the CABO One and Two Family Dwelling Code, and possibly the Uniform Building Code (depending on how it was interpreted) all directed that the measurement used to determine whether or not a guard was required be taken by measuring to the area below the edge of the walking surface, did an unsafe condition exist? No evidence has been submitted with any prior code change to suggest that it did.

Then there are the practical aspects. What distance should a "landing area" be if one were to create one? Should that landing area extend onto another property? The code has always regulated building construction based on situations on the lot in question and given no credence to what occurs on an adjoining lot.

And there are other practicality issues. Permits are not required for a host of "walking surfaces". How does one enforce a guard requirement for things like concrete sidewalks? Do we really see sharp drops or cliffs adjoining low decks or are we more likely to see a gently sloping hill and are they a hazard? And suppose I create a floor or walking surface adjacent my property line and the land on the other side slopes sufficiently that a guard would be required but my neighbor has a fence at the top of the slope on his side of the property line. Do I still need to put up a guard right next to his fence? And if I can use the fence for the guard, does it need to meet the load requirement of 200 pounds at the top? And if I have a walking surface that doesn't require a guard but at a later date the neighboring property owner installs a retaining wall that places my walking surface in violation, is he required to install the guard? He was the one who created the hazard! Will the timing of events result in one situation requiring a guard and another not? How does one explain this to a homeowner and make sense of it?

And last is the issue of permitting of decks, porches, balconies, landings and other low floor surfaces. Low decks were exempted from permits in large part because guards were not required, and they might still not be required. One can only guess that proposals are being drafted to require permits for decks requiring guards. But the inquiry that comes into the building department regarding the need for a guard will go something like this. Q. "Do I need a permit for a deck that will be 28 inches above the ground?" A. "You will need a permit if the ground within X feet of the deck will be more than 30 inches below the floor of the deck at any point around the deck." Q. "I'm a homeowner. I know it will be less than 30 inches above grade around the perimeter of the deck but I don't know about X feet out. So do I need a permit or not? And if I take out a permit and it turns out I didn't need one, I will get my money back, right?"

Homeowners don't have access to sophisticated equipment. They will be dependent on string levels and garden hoses. Accuracy may not be a strong suit. Where will this place the building department?

It is necessary that there be clarity in where a guard is required so that there is uniformity of application and that intended safeguards are in place. It is also necessary that those requirements achieve in all cases what they set out to do. Because most, if not all, of the national model codes did not require that the determining factor of when a guard was required was anything but a direct measurement from the edge of the floor to the ground or floor directly below.

tion) to circulate the heated air to and from the unit. In the context of the code, the primary use of the term "furnace" refers to heating appliance units that combine a combustion chamber with related components, one or more heat exchangers and an air-handling system.

GLAZING AREA. The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements.

❖ The glazing area includes not only the surface area of the exposed glazing but also the framing elements, including the sash and curbing. The amount of glazing area is regulated for natural light by Section R303; however, this definition applies to the energy efficiency provisions of Chapter 11.

GRADE. The finished ground level adjoining the building at all exterior walls.

❖ This is the point at which the finished exterior ground level intersects the exterior wall of the building. The grade around a building may remain relatively constant, such as on a flat site, or may change dramatically from one point to the next if the site is steeply sloping.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

❖ In the requirements for emergency escape and rescue openings found in Section R310, the size of the openings may be reduced if they are grade floor openings. These are windows or other openings that are located within close proximity to the finished ground level. The sill of a grade floor opening may be located either above or below the adjacent ground level, provided it is located no more than 44 inches (1118 mm) vertically from the level of the ground.

GRADE, PIPING. See "Slope."

GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 ft (1829 mm) from the building between the structure and a point 6 ft (1829 mm) from the building.

❖ This definition can be important in determining the number of stories within a building as well as its height in feet. In some cases, the finished surface of the ground may be artificially raised with imported fill to create a higher grade plane around a building to decrease the number of stories or height. The definition requires that the lowest elevation within 6 feet (1829 mm) of the exterior wall be used to determine the grade plane.

GRIDDED WATER DISTRIBUTION SYSTEM. A water distribution system where every water distribution pipe is interconnected so as to provide two or more paths to each fixture supply pipe.

❖ These systems offer the advantage of a simplistic design, typically smaller sized distribution lines and aid water conservation. In a traditional water distribution system, the water contained in the larger diameter piping is wasted when the line is opened and the user has to wait until the water reaches the desired temperature.

Parallel or gridded water distribution systems differ from branch systems which have individual supply pipes that extend to each fixture or outlet from a central supply point [see Commentary Figure R202(1)]. The central supply point is a multiple-outlet manifold to which the distribution lines connect [see Commentary Figure R202(2)].

GROSS AREA OF EXTERIOR WALLS. The normal projection of all exterior walls, including the area of all windows and doors installed therein.

❖ The calculation for determining the gross area of exterior walls for energy efficiency purposes is based on the total area of the entire exterior surface, including openings such as windows and doors.

GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

❖ This definition assists the user with a ready means of distinguishing ground-source heat pump loop systems from other hydronic systems.

GUARD. A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

❖ A guard is a component or system of components whose function is the prevention of falls from an elevated area. Placed adjacent to an elevation change, a guard must be of adequate height, strength and configuration to help prevent people, especially small children, from falling over or through the guard to the area below.

HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

❖ An area within a building used for living, sleeping, dining or cooking is a habitable space. Those areas not meeting this definition include bathrooms, closets, hallways and utility rooms. Habitable spaces are typically occupied, and as such they are more highly regulated than accessory use areas.

HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

to assist ramp users. This provision differs from that of the IBC, where a slope of one unit vertical in 20 units horizontal (5-percent slope) and a ramp rise of 6 inches (152 mm) establishes the limits.

R311.6.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

❖ Where handrails are required, they must be installed at a height of at least 34 inches (864 mm) and not more than 38 inches (965 mm), measured vertically from the finished surface of the ramp slope. This height should be measured to the top of the handrail.

R311.6.3.2 Handrail grip size. Handrails on ramps shall comply with Section R311.5.6.3.

❖ See the commentary for Section R311.5.6.3.

R311.6.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1.5 inches (38 mm) between the wall and the handrails.

❖ The continuity requirement for the ramp handrail is similar to the continuity requirement for the stair handrail. See the commentary for Section R311.5.6.2

SECTION R312
GUARDS

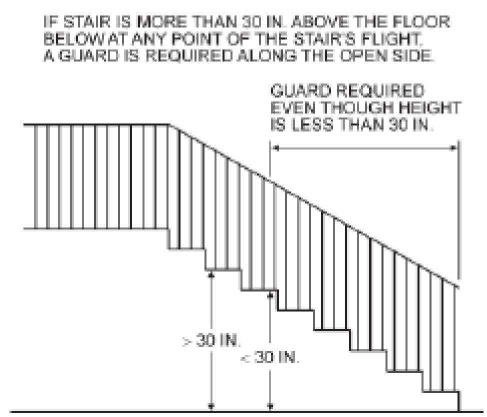
R312.1 Guards. Porches, balconies, ramps or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be equipped with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

❖ The guard provisions of the IRC address the issue of protecting occupants from falling from any type of elevated walking surface. The provisions in Section R312 provide the scoping requirements as well as the general construction requirements for the guards. Besides this section, code users should be aware that Section R301.5 contains the design load criteria for guards.

Section R312.1 of the code establishes the requirement for and the minimum height requirements for guards. The code provides for guard protection at open sides along raised floor or walking surfaces such as those at balconies, mezzanines, stairways, ramps, porches and landings that are more than 30 inches (762 mm) above the grade or floor surface below.

The requirements for guards on stairs are different from other guard requirements in two ways. The first is the scoping requirements that establish the need for the guard, and the second is the required height of the guard. The scoping requirement for guards along open sides of stairs not only applies to the portion of a stairway that is more than 30 inches (762 mm) above the adjacent floor, but it will also apply to the entire open side of the stair, including the parts that are less than 30 inches (762 mm) above the floor. This requirement applies to the entire "open side" of the stairway, if any point of the open side is more than 30 inches (762 mm) high. See Commentary Figures R312.1(1) and (2) for examples of how this provision is applied.



For SI: 1 inch = 25.4 mm.

Figure R312.1(1)
STAIRWAY GUARD

FIRE RESISTANCE or **FIRE-RESISTIVE CONSTRUCTION** is construction to resist the spread of fire, details of which are specified in this code.

FIRE-RETARDANT-TREATED WOOD is any wood product impregnated with chemicals by a pressure process or other means during manufacture, and which, when tested in accordance with UBC Standard 8-1 for a period of 30 minutes, shall have a flame spread of not over 25 and show no evidence of progressive combustion. In addition, the flame front shall not progress more than $10^1/_2$ feet (3200 mm) beyond the center line of the burner at any time during the test. Materials that may be exposed to the weather shall pass the accelerated weathering test and be identified as Exterior type, in accordance with UBC Standard 23-4. Where material is not directly exposed to rainfall but exposed to high humidity conditions, it shall be subjected to the hygroscopic test and identified as Interior Type A in accordance with UBC Standard 23-4.

All materials shall bear identification showing the fire performance rating thereof. Such identifications shall be issued by an approved agency having a service for inspection of materials at the factory.

FLAMMABLE LIQUID. See the Fire Code.

FLOOR AREA is the area included that the surrounding exterior walls of a building or portion thereof, exclusive of vent shafts and courts. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

FM is Factory Mutual Engineering and Research, 1151 Boston-Providence Turnpike, Norwood, Massachusetts 02062.

FOAM PLASTIC INSULATION is a plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of hollow spheres or interconnected cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (320 kg/m^3).

FOOTING is that portion of the foundation of a structure that spreads and transmits loads directly to the soil or the piles.

FRONT OF LOT is the front boundary line of a lot bordering on the street and, in the case of a corner lot, may be either frontage.

SECTION 208 — G

GARAGE is a building or portion thereof in which a motor vehicle containing flammable or combustible liquids or gas in its tank is stored, repaired or kept.

GARAGE, PRIVATE, is a building or a portion of a building, not more than 1,000 square feet (93 m^2) in area, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept. (See Section 312.)

GARAGE, PUBLIC, is any garage other than a private garage.

GAS ROOM is a separately ventilated, fully enclosed room in which only toxic and highly toxic compressed gases and associated equipment and supplies are stored or used.

GRADE (Adjacent Ground Elevation) is the lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet (1524 mm) from the building, between the building and a line 5 feet (1524 mm) from the building.

GRADE (Lumber) is the classification of lumber in regard to strength and utility.

GUARDRAIL is a system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

GUEST is any person hiring or occupying a room for living or sleeping purposes.

GUEST ROOM is any room or rooms used or intended to be used by a guest for sleeping purposes. Every 100 square feet (9.3 m^2) of superficial floor area in a dormitory shall be considered to be a guest room.

SECTION 209 — H

HABITABLE SPACE (ROOM) is space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space, and similar areas, are not considered habitable space.

HANDLING is the deliberate movement of material by any means to a point of storage or use.

HANDRAIL is a railing provided for grasping with the hand for support. See also "guardrail."

HAZARDOUS PRODUCTION MATERIAL (HPM) is a solid, liquid or gas that has a degree of hazard rating in health, flammability or reactivity of 3 or 4 and that is used directly in research, laboratory or production processes that have, as their end product, materials that are not hazardous.

HEALTH HAZARD is a classification of a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed persons. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

HEIGHT OF BUILDING is the vertical distance above a reference datum measured to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitched or hipped roof. The reference datum shall be selected by either of the following, whichever yields a greater height of building:

1. The elevation of the highest adjoining sidewalk or ground surface within a 5-foot (1524 mm) horizontal distance of the exterior wall of the building when such sidewalk or ground surface is not more than 10 feet (3048 mm) above lowest grade.

2. An elevation 10 feet (3048 mm) higher than the lowest grade when the sidewalk or ground surface described in Item 1 is more than 10 feet (3048 mm) above lowest grade.

The height of a stepped or terraced building is the maximum height of any segment of the building.

HELIPORT is an area of land or water or a structural surface that is used, or intended for use, for the landing and take-off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings and other heliport facilities.

HELISTOP is the same as a heliport, except that no refueling, maintenance, repairs or storage of helicopters is permitted.

HIGHLY TOXIC MATERIAL is a material that produces a lethal dose or a lethal concentration that falls within any of the following categories:

hour for unenclosed mezzanines. The clear height above and below the mezzanine floor construction shall not be less than 7 feet (2134 mm).

2. There shall not be more than two levels of mezzanines in a room. However, there is no limitation on the number of mezzanines within a room.

3. The aggregate area of mezzanines within a room shall not exceed one third of the area of the room in which they are located.

4. All portions of a mezzanine shall be open and unobstructed to the room in which they are located, except for columns and posts and protective walls or railings not more than 44 inches (1118 mm) in height.

EXCEPTIONS: 1. Partitioning may be installed if either of the following conditions exist:

1.1 The aggregate floor area of the enclosed space does not exceed 10 percent of the mezzanine area, or

1.2 The occupant load of the enclosed area of the mezzanine does not exceed 10.

2. A mezzanine having two or more means of egress need not be open into the room in which it is located, provided at least one of the means of egress gives direct access to a protected corridor, exit court or exit.

3. In industry facilities, mezzanines used for control equipment may be glazed on all sides.

5. Two means of egress shall be provided from a mezzanine when two are required by Table 10-A.

6. If any required means of egress enters the room below, the occupant load of the mezzanine shall be added to the occupant load of the room in which it is located.

SECTION 508 — FIRE-RESISTIVE SUBSTITUTION

When an approved automatic sprinkler system is not required throughout a building by other sections of this code, it may be used in a building of Type II One-hour, Type III One-hour and Type V One-hour construction to substitute for the one-hour fire-resistive construction. Such substitution shall not waive or reduce the required fire-resistive construction for:

1. Occupancy separations (Section 302.3).
2. Exterior wall protection due to proximity of property lines (Section 503.2).
3. Area separations (Section 504.6).
4. Dwelling unit separations (Section 310.2.2)
5. Shaft enclosures (Section 711).
6. Corridors (Sections 1004.3.4.3.1 and 1004.3.4.3.2).
7. Stair enclosures (Section 1005.3.3).
8. Exit passageways (Section 1005.3.4).
9. Type of construction separation (Section 601.1).
10. Boiler, central heating plant or hot-water supply boiler room enclosures (Section 302.5).

SECTION 509 — GUARDRAILS

509.1 Where Required. Unenclosed floor and roof openings, open and glazed sides of stairways, aisles, landings and ramps, balconies or porches, which are more than 30 inches (762 mm) above grade or floor below, and roofs used for other than service of the building shall be protected by a guardrail. Guardrails shall be provided at the ends of aisles where they terminate at a fascia of boxes, balconies and galleries.

EXCEPTION: Guardrails need not be provided at the following locations:

1. On the loading side of loading docks.

2. On the auditorium side of a stage, raised platforms and other raised floor areas such as runways, ramps and side stages used for entertainment or presentation. Along the side of an elevated walking surface when used for the normal functioning of special lighting or for access and use of other special equipment. At vertical openings in the performance area of stages.

3. Along vehicle service pits not accessible to the public.

509.2 Height. The top of guardrails shall not be less than 42 inches (1067 mm) in height.

EXCEPTIONS: 1. The top of guardrails for Group R, Division 3 and Group U, Division 1 Occupancies and interior guardrails within individual dwelling units, Group R, Division 3 congregate residences and guest rooms of Group R, Division 1 Occupancies may be 36 inches (914 mm) in height.

2. The top of guardrails on a balcony immediately in front of the first row of fixed seats and that are not at the end of an aisle may be 26 inches (660 mm) in height.

3. The top of guardrails for stairways, exclusive of their landings, may have a height as specified in Section 1003.3.3.6 for handrails.

Where an elevation change of 30 inches (762 mm) or less occurs between an aisle parallel to the seats (cross aisle) and the adjacent floor or grade below, guardrails not less than 26 inches (660 mm) above the aisle floor shall be provided.

EXCEPTION: Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guardrail need not be provided.

The top of guardrails at the ends of aisles terminating at the fascia of boxes, balconies and galleries shall extend for the width of the aisle and be no closer than 42 inches (1067 mm) to the closest surface of the aisle where there are steps and 36 inches (914 mm) otherwise.

509.3 Openings. Open guardrails shall have intermediate rails or an ornamental pattern such that a sphere 4 inches (102 mm) in diameter cannot pass through.

EXCEPTIONS: 1. The open space between the intermediate rails or ornamental pattern of guardrails in areas of commercial and industrial-type occupancies which are not accessible to the public may be such that a sphere 12 inches (305 mm) in diameter cannot pass through.

2. The triangular openings formed by the riser, tread and bottom element of a guardrail at the open side of a stairway may be of such size that a sphere 6 inches (152 mm) in diameter cannot pass through.

For guardrail requirements at grandstands, bleachers or other elevated seating facilities, see Section 1008.5.7.

The floor area calculation is of such importance that the designer should establish this figure early in the preliminary discussions with the local enforcement agency.

> Sec. 408. GARAGE is a building or portion thereof in which a motor vehicle containing flammable or combustible liquids or gas in its tank, is stored, repaired or kept.
> GARAGE, PRIVATE, is a building or a portion of a building, not more than 1000 square feet in area, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept. (See Section 1101.)
> GARAGE, PUBLIC, is any garage other than a private garage.

There are several definitions, and three different classifications, of garages. The least restrictive definition refers to a garage in conjunction with a dwelling or a small office building: a "private garage." It is classified as a Group M Occupancy.

When the garage is larger, or if it is in a larger building or serves occupants other than those in the building, it is called a "public garage." This garage is classified as a Group B, Division 1 Occupancy.

The third class of garage is a "repair garage" classed as a Group H, Division 4 Occupancy.

The reason for the three different garage classes is illustrated in Table No. 5-C. In a Type III-N building, a Group B, Division 1 Occupancy allows a floor area of 12,000 square feet. In a similar building, a Group H, Division 4 Occupancy limits the floor area to 7,500 square feet. The smaller allowable area is due to the presence of repair equipment, including torches and flammable liquids (oil and gasoline) which may permeate the area when repairs are made.

On the other hand, the Group M private garage is limited to 1,000 square feet with a maximum of 3,000 square feet in any one building. The provisions in Chapter 11 enable the private garage to reach the maximum of 3,000 square feet in the building provided each 1,000 square foot area is separated from another by a one-hour area separation wall.

> GRADE (Adjacent Ground Elevation) is the lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet from the building, between the building and a line 5 feet from the building.

This definition requires that the elevation of the ground surface to be used be either:

* *the level between the building and the property line, or*
* *where the property line is more than five feet from the building, the lowest point within a distance of five feet from the building.*

The code intent is to establish what would be a "natural" ground line and to prevent someone from piling soil up against the foundation of the building and claiming that it represents the grade. By requiring the measurement to be the lowest elevation within five feet of the building, the code establishes a five-foot width to represent grade and not simply a mound of earth against the foundation. A retaining wall can be used to establish this five-foot level width.

The determination of the grade level is important to the designer for several reasons, including the qualification of a level as a basement and the measurement of the allowable overall height of the building. (See Figure 4-2.)

HEIGHT OF BUILDING is the vertical distance above a reference datum measured to the highest point of the coping of a flat roof or to the deck line of a mansard roof or to the average height of the highest gable of a pitched or hipped roof. The reference datum shall be selected by either of the following, whichever yields a greater height of building:

1. **The elevation of the highest adjoining sidewalk or ground surface within a five-foot horizontal distance of the exterior wall of the building when such sidewalk or ground surface is not more than 10 feet above lowest grade.**
2. **An elevation 10 feet higher than the lowest grade when the sidewalk or ground surface described in Item 1 above is more than 10 feet above lowest grade.**

The height of a stepped or terraced building is the maximum height of any segment of the building.

Height of building discussed in this definition relates to the provisions in Chapter 5 for considering the maximum height for a given type of construction and number of stories in a building.

Height and stories are interdependent in Table No. 5-D wherein the limitations for the height in feet and the number of stories are established. The provisions for measuring the height require reference to the ground surface. The five-foot horizontal width in Item 1 is comparable to the five-foot width measurement for determining "grade."

The concern with the method of height measurement is based on the fire and panic hazards presented by taller structures or those with more levels of occupancy. Many times the misinterpretation or misapplication of the height and story measurement has been the result of a desire to avoid the added exit and fire protection requirements that apply when a building is three or more stories in height.

The designer is cautioned that any error in this part of the design can produce considerable repercussions; hence, the designer should use a conservative approach to the height measurement.

> **HOTEL** is any building containing six or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests.

The hotel is another sub-group of the R-1 Occupancy, multi-family usage. The controlling criterion is the number of guest rooms rather than dwelling units (as is used in the apartment house definition).

> **MECHANICAL CODE** is the Uniform Mechanical Code promulgated jointly by the International Conference of Building Officials and the International Association of Plumbing and Mechanical Officials, as adopted by this jurisdiction.

One of the codes referenced in the UBC provisions is the Mechanical Code, in particular the Uniform Mechanical Code (UMC). It is adopted by a jurisdiction in a similar manner as is the UBC.

> **MEZZANINE OR MEZZANINE FLOOR** is an intermediate floor placed within a room.

The construction provisions for mezzanines are contained in Section 1716. The key determinant in whether a level qualifies as a mezzanine is stated in Item 3 of that section, which reads:

> 3. The aggregate area of mezzanines within a room shall not exceed one third the area of the room in which it is located. Intermediate floor levels that are 6 or more feet above grade shall be considered a story when the area of such level exceeds one third the area of the room in which it is located.

> Sec. 415. **NONCOMBUSTIBLE** as applied to building construction material means a material which, in the form in which it is used, is either one of the following:
>
> 1. Material of which no part will ignite and burn when subjected to fire. Any material conforming to U.B.C. Standard No. 4-1 shall be considered noncombustible within the meaning of this section.
> 2. Material having a structural base of noncombustible material as defined in Item No. 1 above, with a surfacing material not over 1/8 inch thick which has a flame-spread rating of 50 or less.
>
> "Noncombustible" does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item No. 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread rating, beyond the limits herein established,

HANDBOOK

TO THE

UNIFORM BUILDING CODE

An illustrative commentary

International Conference of Building Officials

SECTION 208 — G

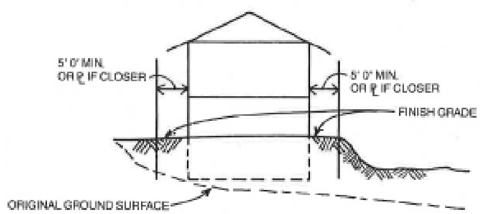
GRADE (Adjacent Ground Elevation). The code indicates that grade is the lowest point of elevation of the finished surface of the ground within an area between the building and property line or where the property line is more than 5 feet (1524 mm) from the building between the building and a line 5 feet (1524 mm) from the building.

This definition is important in determining the number of stories within a building as well as its height in feet. In some cases the finished surface of the ground may be artificially raised with imported fill to create a higher grade around a building so as to decrease the number of stories or height in feet. The code does not prohibit this practice, and as long as a building meets the code definition and restrictions for height or number of stories, the intent of the code is met. See Figure 208-1.

SECTION 209 — H

HEIGHT OF BUILDING. The critical feature in the definition of height of building is the case where the building is on a sloping site. In the case of a sloping site, the height of the building is measured as depicted in Figure 209-1.

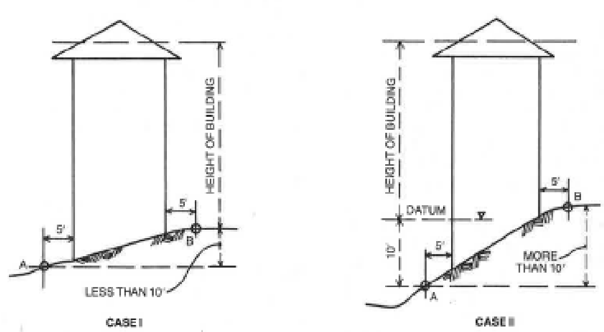
Where the building is stepped or terraced, the code intends that the height of such building is the maximum height of any segment of the building. It may be appropriate under certain circumstances that the number of stories in a building be determined in the same manner. Because of the varying requirements of the code which are related to the number of stories, such as exiting, fire resistance of construction, shaft enclosures, etc., each case should be judged individually based on the characteristics of the site and construction. In addition to those factors which are related to the number of stories, other items to consid-



For SI: 1 foot = 304.8 mm.

USE OF BUILT-UP SOIL TO RAISE FINISH GRADE

Figure 208-1



For SI: 1 foot = 304.8 mm.

DETERMINATION OF BUILDING HEIGHT IN FEET (mm)

Figure 209-1

Application Example 508-1

GIVEN: One-story building of Type V-N construction with an automatic fire-sprinkler system installed throughout. The building has no yards.

DETERMINE: Maximum allowable floor area for the building housing either a Group B Occupancy or a Group A, Division 2.1 Occupancy.

SOLUTION: *Case I*—Group B Occupancy:

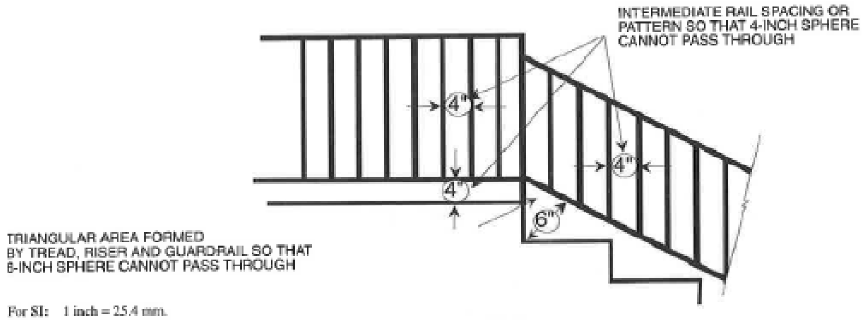
The building can be evaluated with the automatic fire sprinklers used either to increase area according to Section 505.3 or to substitute for one-hour construction according to Section 508, thus upgrading the construction from Type V-N to Type V One-hour.

A. Section 505.3. Basic allowable area according to Table 5-B is 8,000 square feet for Type V-N construction.
Allowable Area = 8,000 x 3 = 24,000 square feet.

B. Section 508. Basic allowable area according to Table 5-B is 14,000 square feet for Type V One-hour. Obviously, it is more advantageous to use the provisions of Section 505.3.

Case II—Group A, Division 2.1 Occupancy:

Referring to Table 5-B, it is seen that a Group A, Division 2.1 Occupancy is not permitted to be of Type V-N construction. Thus, the automatic fire-sprinkler system must be used as a substitute for one-hour construction in order that the building will qualify as Type V One-hour construction. The allowable area for this type of construction is 10,500 square feet housing a Group A, Division 2.1 Occupancy.



For SI: 1 inch = 25.4 mm.

GUARDRAILS

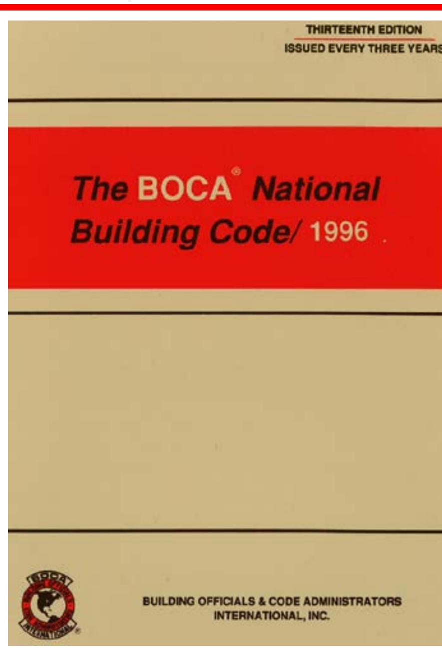
Figure 509-1

SECTION 509 — GUARDRAILS

In this section, the code provides for guardrail protection for unenclosed floor and roof openings, open and glazed sides of stairways, landings and ramps, and porches, which are more than 30 inches (762 mm) above grade or a floor or other surface below. Also, the protection is required for roofs which are used other than for service of the building and thus are subject to use by individuals walking on the roof. The need for guardrails in these circumstances is evident, although the arbitrary limit of 30 inches (762 mm) above grade or floor below is subject to conjecture. Nonetheless, in the case of the U.B.C., it is assumed that the height of 30 inches (762 mm) does not create a significant safety hazard.[5]

The guardrail must be of adequate height to prevent someone from falling over the edge of the protected areas and be designed to prevent someone, including small children, from falling through under the top rail. Therefore, the code establishes 42 inches (1067 mm) as the minimum height which is recognized nationally as the proper height for guardrail protection. The code also requires that for open-type rails, intermediate members be provided so that a sphere 4 inches (102 mm) in diameter cannot pass through between the intermediate members, a requirement which prevents small children from falling through the guardrail assembly. See Figure 509-1. The code also lessens the height for open sides of stairs; they may be protected with a guardrail having a height the same as for stair railings as provided for in Section 1006.9. There are several more exceptions to the requirements for guardrails, as follows:

- Guardrails are not required on the loading side of docks or along vehicle service pits not accessible to the public for obvious reasons.
- Guardrails are required to be only 36 inches (914 mm) high in dwellings, Group U Occupancies, and within individual apartments or guest rooms in Group R, Division 1 Occupancies. This lower height is based on the good experience that has been exhibited in these uses; for several decades, the guardrail height in them has been no higher than 36 inches (914 mm).
- In commercial and industrial uses where the public is not invited (therefore, the guardrail is not subject to small children falling through), guardrails may have intermediate members spaced so that a 12-inch (305 mm) diameter sphere cannot pass through.
- In order to provide for proper viewing in theaters, a guardrail in front of the first row of fixed seats, and which is not at the end of an aisle, may be 26 inches (660 mm) in height.
- Again for obvious reasons, guardrails are not required on the auditorium side of a stage or enclosed platform.



1020.2 Vestibule: Where an *exit* discharges into an interior vestibule, the vestibule shall be used for ingress and *means of egress* only, and the vestibule shall comply with Sections 1020.2.1 and 1020.2.2.

1020.2.1 Depth and width: The vestibule depth from the exterior of the building shall not be greater than 10 feet (3048 mm) and the width shall not be greater than 20 feet (6096 mm).

1020.2.2 Separation: The vestibule shall be separated from the remainder of the *level of exit discharge* by self-closing doors and the equivalent of ¼-inch-thick wired glass in steel frames.

1020.3 Lobby: Where an *exit* discharges into an interior *lobby* located at the *level of exit discharge*, the story containing the *lobby* shall be equipped throughout with an *automatic sprinkler system* installed in accordance with Section 906.2.1 or 906.2.2. Opening protectives shall be required in accordance with Table 717.1 at the point in which an enclosed *exit stairway* discharges into a lobby.

Exception: An *automatic sprinkler system* is not required in areas that are separated from the *lobby* by *fire separation assemblies* (see Section 709.0) having a fireresistance rating of not less than that required for *exit* enclosures.

1020.4 Width and height: The clear width of the passageway shall not be less than the width required for the capacity of the *exit stairways* leading thereto and all required *exit* doorways opening into the passageway. Such passageway shall have a minimum width of 44 inches (1118 mm) and a minimum clear ceiling height of 8 feet (23438 mm).

1020.5 Maximum stairway limitations: Not more than 50 percent of the required *stairways* shall discharge through the same passageway. Multiple *lobbies* constructed in accordance with Section 1020.3 located adjacent to one another shall be separated from each other in accordance with the requirements for enclosure of *exits*.

SECTION 1021.0 GUARDS

1021.1 Design and construction: Where required by the provisions of Sections 406.5, 408.3.2, 1005.5, 1014.7, 1016.5 and 825.5, guards shall be designed and constructed in accordance with the requirements of this section and Section 1606.4.

1021.2 Height: The guards shall be at least 42 inches (1067 mm) in height measured vertically above the leading edge of the tread or adjacent walking surface.

Exceptions

1. In other than occupancies in Use Group E, guards shall not be less than 36 inches (914 mm) in height above the leading edge of the tread along stairs which are not more than 20 feet (6096 mm) in height or which reverse direction at an intermediate landing with 12 inches (305 mm) or less measured horizontally between successive flights.
2. Guards along open-sided floor areas, *mezzanines* and landings within a single *dwelling unit* in Use Group R-2 and serving a single *dwelling unit* in Use Group R-3 shall not be less than 36 inches (914 mm) in height.
3. Guards along open-sided floor areas located less than 30 inches (762 mm) above the floor or grade below shall not be less than 36 inches (914 mm) in height.

1021.3 Opening limitations: In occupancies in Use Groups A, B, E, H-4, I-1, I-2, M and R, and in *public garages* and open parking structures, open guards shall have balusters or be of solid material such that a sphere with a diameter of 4 inches (102 mm) cannot pass through any opening. Guards shall not have an ornamental pattern that would provide a ladder effect.

Exceptions

1. The triangular openings formed by the riser, tread and bottom rail at the open side of a *stairway* shall be of a maximum size such that a sphere 6 inches (152 mm) in diameter cannot pass through the opening.
2. At elevated walking surfaces for access to and utilization of electrical, mechanical, or plumbing systems or equipment, guards shall have balusters or be of solid materials such that a sphere with a diameter of 21 inches (533 mm) cannot pass through any opening.

In occupancies in Use Groups I-3, F, H-1, H-2, H-3, S, (other than *public garages* and open parking structures), and along open-sided floor areas located less than 30 inches (762 mm) above the floor or grade below, balusters, horizontal intermediate rails or other construction shall not permit a sphere with a diameter of 21 inches (533 mm) to pass through any opening.

1021.4 Railings: Metal or other approved noncombustible railings shall be provided on balconies and galleries as prescribed in Sections 1021.4.1 through 1021.4.3.

1021.4.1 At fascia: Railings shall be provided at the fascia of boxes, balconies and galleries and shall not be less than 26 inches (660 mm) in height; at the end of aisles extending to the fascia for the full width of the aisle and shall not be less than 36 inches (914 mm) in height; and at the foot of steps for the full width of the steps and shall not be less than 42 inches (1067 mm) in height.

1021.4.2 At cross aisles: Railings shall be provided along cross aisles, and shall not be less than 26 inches (660 mm) in height except that railings are not required where the backs of the seats along the front of the aisles project 24 inches (610 mm) or more above the floor of the aisle.

1021.4.3 Successive tiers: Where seatings are arranged in successive tiers, and where the height of rise between *platforms* exceeds 18 inches (457 mm), railings not less than 26 inches (660 mm) in height shall be provided along the entire row of seats at the edge of the *platform*.

SECTION 1022.0 HANDRAILS

1022.1 General: Where required by the provisions of Sections 1012.5, 1013.0, 1014.6.6.1, 1014.7 and 1016.5, handrails shall be designed and constructed in accordance with this section and Section 1606.4.

1022.2 Handrail details: Handrails shall be continuous, without interruption by newel posts, other structure elements or obstructions. A handrail and any wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements. The clear space between the handrail and the adjacent wall or surface shall

SECTION 502.0 DEFINITIONS

502.1 General: The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

Area, building: The *area* included within surrounding exterior walls (or exterior walls and *fire walls*) exclusive of vent *shafts* and *courts*. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

Basement: That portion of a building which is partly or completely below grade (see "*Story above grade*").

Grade plane: A reference plane representing the average of finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

Height

Building: The vertical distance from *grade plane* to the average height of the highest roof surface.

1005.5 Open-sided walking areas: Guards shall be located along open-sided walking surfaces, *mezzanines*, *stairways*, ramps and landings which are located more than 15½ inches (394 mm) above the floor or grade below. The guards shall be constructed in accordance with Section 1021.0.

Exception: Guards are not required for the following locations:

1. On the loading side of loading docks.
2. On the auditorium side of *stages* and raised *platforms*.
3. On raised *stage* and *platform* floor areas such as runways, ramps and side *stages* utilized for entertainment or presentations.
4. At vertical openings in the performance area of *stages* and *platforms*.
5. At elevated walking surfaces appurtenant to *stages* and *platforms* for access to and utilization of special lighting or equipment.

GALLERY-that portion of the seating space of an assembly room having a seating capacity of more than ten located above a balcony.

GRADE-a reference plane representing the average of finished ground level adjoining the building at all exterior walls. When the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or between the building and a point 6 ft (1829 mm) from the building, whichever is closer to the building.

GRADE, LUMBER-the division of sawn lumber into quality classes with respect to its physical

SOUTHERN BUILDING CODE

1015 GUARDRAILS

1015.1 General

All unenclosed floor and roof openings, open and glazed sides of landings and ramps, balconies or porches which are more than 30 inches (762 mm) above finished ground level or a floor below shall be protected by a guardrail. Guardrails shall form a vertical protective barrier not less than 42 inches (1067 mm) high. Open guardrails shall have intermediate rails or ornamental pattern such that a 6-inch (152 mm) diameter sphere cannot pass through any opening. A bottom rail or curb shall be provided that will reject the passage of a 2-inch (51 mm) diameter sphere. Construction of guardrails shall be adequate in strength, durability and attachment for their purpose as described in 1608.2.

EXCEPTIONS:

1. Guardrails are not required on the loading side of loading docks.

2. Guardrails shall be permitted in conformance with requirements for specific occupancies in 1018.

1015.2 Glass

Cost Impact: None

RB143-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R312.1-RB-DAVIDSON

RB144 – 13
R312.1.1, Chapter 44

Proponent: Mitch Markham, representing Ascend Restoration Services

Revise as follows:

R312.1.1 Where Required. *Guards* shall be located along open-sided walking surfaces, including stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or *grade* below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a *guard.*

> <u>**Exception:** Permanent fall arrest and restraint anchorage connector devices meeting ANSI/ASSE Z359.1 affixed for use during the entire roof covering lifetime shall be permitted where mechanical equipment, systems, devices and various components that require service are located on roof surfaces. Fall arrest/restraint devices shall be reevaluated for possible replacement when the entire roof covering is replaced. The devices shall be placed no more than 10 feet (3048 mm) on center along hip and ridge lines and placed not less than 10 feet (3048 mm) from the roof edge or open side of the walking surface.</u>

Add new standards to Chapter 44 as follows:

ANSI American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

<u>Z359.1-07 Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components</u>

ASSE American Society of Sanitary Engineering
901 Canterbury, Suite A
Westlake, OH 44145

<u>Z359.1-2007 Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components</u>

Reason: This proposal is intended to correlate with E108-12 which was approved at the 2012 FAH as a consent agenda item during the code Group A process. This proposal is needed so there is consistency and correlation between the ICC codes. E108-12 added clarity to IBC sections 1013.6 and 1013.7, IFC sections 1013.6 and 1013.7, and IMC section 304.11. The existing code provisions requiring the construction of guards do not adequately address the expanding list of equipment, assemblies, systems, devices and items that are now commonly being placed on roof tops and elevated walking surfaces that require routine maintenance. The current requirement needs clarification and a cost effective alternative to constructing a guard on a roof since a guard is a method of fall protection required at the edge of elevated surfaces where people will walk and will provide service to roof-located equipment and other systems or devices. The code change proposal adds clarity to the current code language by identifying items within the exception that are now typical placements on roofs and elevated walking surfaces. This expands the fall protection, life-safety provisions to a growing number of trades and service workers that are working on elevated surfaces. The proposal also provides an alternate method of compliance with the inclusion of an exception which allows for the installation of fall arrest/restraint anchorage connector devices meeting ANSI Z359.1 which is the nationally recognized consensus general industry standard in use across the country. The proposed exception is a choice made by the designer and building owner that provides design flexibility and the opportunity to lower construction cost associated with building guards. The proposal will increase the uniform application of this section of the code. The Bureau of Labor Statistics, US Department of Labor reports the fatalities due to falls for the years from 1998 to 2010 are second to only highway incidents, with an average of 743 fatalities each year over this 12 year period. Of the 635 fatal falls in 2010, one third is from falls from ladders or roofs. In 2010 the construction industry had the highest number of fatal occupational injuries. In 2010 for nonfatal falls the median number of days away from work due to falls to a lower level was 14 days. Clearly the code needs to be improved to provide fall protection where mechanical equipment, appliances, equipment, fans, roof hatch openings, solar arrays, solar water heaters, photovoltaic panels, skylights, chimneys, attic vents, and ventilators, satellite dishes, antennas, television/radio/internet and other communication equipment and all other machinery and other components that require service are located on elevated surfaces more than 30 inches above a lover level.

Cost Impact: The code change proposal will not increase the cost of construction because the current code provisions can be interpreted to have the intent to require guards at all elevated working level more than 30 inches above a floor, roof or grade. The inclusion of an exception provides a choice to the builder and homeowner to lower the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, [ANSI/ASSE Z359.1-2007] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB144-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R312.1.1-RB-MARKHAM

RB145 – 13
R312.1.2

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov); Steve Thomas, Colorado Code Consulting, LLC representing the Colorado Chapter ICC (sthomas@coloradocode.net)

Revise as follows:

R312.1.2 Height. Required *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) high measured vertically above the adjacent walking surface~~, adjacent fixed seating~~ or the line connecting the leading edges of the treads.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the *guard* also serves as a handrail on the open sides of stairs, the top of the *guard* shall not be less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

Reasons:
Davidson: This proposal deletes the term "adjacent fixed seating" from the rules on guards. The term "fixed seating" is not defined. This makes the intent ambiguous and unclear. This will result in a lack of uniformity. There is no evidence to suggest that this rule serves any purpose or that it corrects any problems. There was never any evidence submitted that there is a problem.

The intent of the current language could result in guards being five or six feet in height. Designing a guard to meet the load requirements at the top of such a guard will result in significant attachment concerns because the current load requirements were based on the assumption that the guard would only be 36 inches high and the code requires that the design load for guards be at the top. This code requirement is unreasonable because compliance with the rule will be extremely expensive yet provide little increase in safety over the previous rules.

Furthermore, it penalizes designs using fixed seating all the while ignoring chairs and other furniture than can be easily pushed next to a guard creating the same potential circumstances. If we really wanted to address a safety hazard, we would require self closing gates be installed across all stairways to prevent children from falling down stairs which is a much more frequent occurrence.

To avoid expensive and unintended design costs and to avoid confusion and a lack of uniformity of enforcement, this term must be deleted. It is reasonable to delete the term because the current language in the code has not been shown to cause unsafe conditions.

Thomas: This change is to delete the requirement to extend a guard 36 inches above the surface of fixed seating. The same requirement was deleted out of the 2012 IBC. Subsequent attempts to put it back in the 2015 IBC failed in Portland. This proposal will make the two codes consistent with each other in this area.

The original requirement was lumped in a larger change that was made to the guard provisions in the code. There was no technical justification to raise the height of the guard at the back of fixed seating. There was also no definition of what fixed seating is. This should never have been put in the IRC in the first place.

We feel that this requirement is over-restrictive. The responsibility of keeping children from climbing on the back of a deck bench or some type of landscape wall should not be placed on the code. At some point, parents need to be responsible for their children. Raising the height of the bench back rest to a height of 54 inches above the deck will not prevent children from climbing over and falling.

Cost Impacts :
Davidson: None
Thomas: This will reduce the cost of construction.

RB145-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R31.1.2-RB-DAVIDSON-THOMAS

RB146 – 13
R312.2.1

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee (cbaldassarra@rjagroup.com)

Revise as follows:

R312.2 Window fall protection. Window fall protection shall be provided in accordance with Sections R312.2.1 and R312.2.2.

R312.2.1 Window sills. In dwelling units, where ~~the opening of an operable window is located more than 72 inches (1829 mm) above the finished grade or surface below, the lowest part of the clear opening of the window shall be a minimum of 24 inches (610 mm) above the finished floor of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4-inch-diameter (102 mm) sphere where such openings are located within 24 inches (610 mm) of the finished floor.~~ the top of the sill of an operable window opening is located less than 24 inches above the finished floor and greater than 72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, the operable window shall comply with one of the following:

~~**Exceptions:**~~

1. Operable windows whose openings will not allow a 4- inch-diameter (102 mm) sphere to pass through the opening when the opening is in its largest opened position.
2. Operable windows ~~Openings~~ that are provided with window fall prevention devices that comply with ASTM F 2090.
3. Operable windows that are provided with window opening control devices that comply with Section R312.2.2.

Reason: This proposed change is a result of the CTC's investigation of the area of study entitled "Child Window Safety". The scope of the activity is noted as:

To evaluate the necessity of developing code proposals for the inclusion of requirements dealing with the conditions, circumstances and devices for window safety which could reduce the number of falls by children to surfaces below.

The purpose of this proposal is to coordinate the IRC with the changes approved to the IBC in the 2012 Group A cycle. Specifically, Code change E109-12 was approved as submitted to revise Section 1013.8 of the IBC (see below).

The CTC examined the IBC provisions during the preparation of the code changes for existing buildings and several questions came up regarding the original intent and the scope of what was being regulated. The IBC language was clarified to specify that the hazard exists with all windows in a dwelling unit and the height is to be measured to the top of the sill of an operable window. Additionally, , the exceptions aren't actually exceptions, but conditions where various devices and their standards are allowed to be used. It should be noted that the minimum sill height in the IBC is 36 inches and this proposal retains the current 24 inch minimum sill height in the IRC.

For reference, the approved IBC text is as follows:

IBC 1013.8 Window openings. *All windows in Groups R-2 and R-3 buildings including dwelling~~s~~ units, where the top of the sill of an operable window opening is located less than 36 inches above the finished floor and greater than 72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, shall comply with one of the following:*

1. *Operable windows where the top of the sill of the opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below and that are provided with window fall prevention devices that comply with ASTM F 2006.*
2. *Operable windows whose openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the window is in its largest opened position.*
3. *Operable windows whose openings that are provided with window fall prevention devices that comply with ASTM F 2090.*
4. *Operable windows that are provided with window opening control devices that comply with Section 1013.8.1.*

1013.8.1 Window opening control devices. *Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2.*

This proposal is submitted by the ICC Code Technology Committee. The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as “areas of study”. Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/CTC/Pages/default.aspx. Since its inception in April/2005, the CTC has held twenty-five meetings - all open to the public. In 2012, three of the 25 face-to face meetings were held. In addition to the CTC meetings, the CTC established Study Groups (SG) of interested parties for each of the areas of study. These SG’s are responsible for reviewing the available information and making recommendations to the CTC. All totaled, the SG’s held over 70 conference calls in 2012.

Cost Impact: This code change proposal will not increase the cost of construction.

RB146-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R312.2.1-RB-BALDASSARRA-CTC

RB147 – 13
R312.2.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R312.2 Window fall protection. Window fall protection shall be provided in accordance with Sections R312.2.1 and R312.2.2.

R312.2.1 Window sills. In dwelling units, where the opening of an operable window is located more than 72 inches (1829 mm) above the finished grade or surface below, the lowest part of the clear opening of the window shall be a minimum of ~~24~~ 36 inches (610 mm) above the finished floor of the room in which the window is located or above window seats or other adjacent fixed seating. Operable sections of windows shall not permit openings that allow passage of a 4-inch-diameter (102 mm) sphere where such openings are located within ~~24~~ 36 inches (610 mm) of the finished floor or above window seats or other adjacent fixed seating.

Exceptions:

1. Windows whose openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the opening is in its largest opened position.
2. Openings that are provided with window fall prevention devices that comply with ASTM F 2090.
3. Windows that are provided with window opening control devices that comply with Section R312.2.2.

Reason: It has been pointed out at recent hearings that the minimum sill height for child fall protection was set at 24 inches as a compromise. It is time to face reality and raise the sill height requirements to a justifiable level. This is a child safety issue and should be given a high priority. Children continue to fall out of windows resulting in serious injuries and deaths.

We require smoke alarms in bedrooms. The reason – adults smoke in bed and set themselves on fire.

We require Carbon Monoxide alarms in homes when the incidence of CO poisoning is rare. The reason – an adult might use their charcoal grill in their living room.

We require ramps to be flatter for single family dwellings than other buildings. The reason – adults need to be told what slope is best for them.

We require fire protection of floors in dwellings. The reason – fire fighters are entering buildings that have active fires below the floors of entry.

We require sprinklers in dwellings. The reason – smoking and cooking fires, the biggest cause of residential fires, occur because of inattention by adults.

We require large window wells for basement windows and then debate the need for guards to keep people from falling in them. We can't even agree on where guards should be placed or when they should be required to protect adults!

We have approved code changes to protect fire fighters, older people, younger people, smokers, and people who use charcoal grills in their living rooms. Yet children seem to be left out and when something is proposed to make things safer for children the events are said to be a parenting issue! Are the examples above also "parenting issues"? At least in my area of the country, it seems hardly a week goes by without the report of another child falling out of a window and being seriously injured or killed. And these events are occurring in single family homes. The fact of the matter is that children cannot be watched all of the time. Children falling out of windows is not a parenting issue, it is a poor design issue.

Guards are required to be not less than 36 inches in height and opening protection to prevent a 4 inch sphere from passing through the guard extends to the full height of the guard, not just the first 24 inches. The same should hold true for window openings because the risk is the same.

In the past you have heard a number of absurd arguments against proposals to increase sill heights and window fall protection in general. One argument is that a 24 inch sill height is safer than a 36 inch sill height because it is less likely that furniture will be placed in front of a window with a 24 inch sill. There have never been any scientific studies to support such a brainchild. And taken to an extreme, if 24 inches is safer than 36 inches, then 12 inches should be safer yet and if we really want to be safe we would mandate window openings start at the floor! Seriously, the studies that are out there contradict the claims that lower windows are safer. The vast majority of children fall out of windows with no furniture in front of them and that are located close to the floor. Toddlers are particularly susceptible and the lower sill heights act as a pivot for children of this age. Being top heavy, children simply leaning out a window can cause a fall. The average height of a two-year old is 31 inches. The average height of a four-year old is 37 inches. It doesn't take a rocket scientist to see that children of these ages and these heights and lower window sill are a recipe for disaster and that is exactly what is happening.

There are numerous solutions available that would allow windows with to extend all the way to the floor if the designer wishes. And if the membership agrees to eliminate the need for emergency escape windows in sprinklered homes, that eliminates another concern.

Numerous requirements without substantiated need have been placed in the code in recent years that, at best, will provide limited benefit to a very small handful of individuals. Here we have an opportunity to provide increased levels of safety for children. This should be the proverbial "no-brainer".

Cost Impact: None

RB147-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R312.2.1-RB-DAVIDSON

RB148 – 13

R313.1 (New), R313.1.1, R313.2, R313.2.1, R313.4 (New), R302.2

Proponent: Matt Archer, Douglas County, CO, representing self (marcher@douglas.co.us)

Revise as follows:

R313.1 General. The design, installation, inspection, maintenance, repair and replacement of residential automatic fire sprinkler systems and components shall comply with the manufacturer's instructions and Section P2904.

R313.~~1~~ 2 Townhouse ~~automatic fire sprinkler systems~~. An automatic residential fire sprinkler system shall be installed in *townhouses*.

> **Exception:** ~~An automatic residential fire sprinkler system shall not be required when *additions* or *alterations* are made to existing *townhouses* that do not have an automatic residential fire sprinkler system installed.~~ Townhouses separated by a fire rated wall assembly totaling 2 hours in accordance with Section R302.2 and fire protected floors complying with Section R501.3 shall not be required to have an automatic residential fire sprinkler system.

~~**R313.1.1 Design and installation.** Automatic residential fire sprinkler systems for *townhouses* shall be designed and installed in accordance with Section P2904.~~

~~R313.2~~ R313.3 One- and two-family dwelling~~s automatic fire systems.~~ An automatic residential fire sprinkler system shall be installed in one- and two-family *dwellings*.

> **Exception:** One- and two-family dwellings complying with the exterior wall construction of Table 302.1(1) and fire protected floors complying with Section R501.3 shall not be required to have an automatic residential fire sprinkler system.

> ~~**Exception:**~~ **R313.4 Additions and alterations.** An automatic residential fire sprinkler system shall not be required for *additions* or *alterations* to existing buildings that are not already provided with an automatic residential sprinkler system.

~~**R313.2.1 Design and installation.** Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904 or NFPA 13D.~~

R302.2 Townhouses. Each *townhouse* shall be considered a separate building and shall be separated by fire-resistance-rated wall assemblies meeting the requirements of Section R302.1 for exterior walls.

> **~~Exception~~ Exceptions:**

1. Townhouses with an automatic residential fire sprinkler system are permitted to have a common 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263. ~~is permitted for townhouses if such walls do~~ The common wall shall not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be installed in accordance with Chapters 34 through 43. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4.
2. A common 2 hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses where such walls do not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall.

Reason: Creating a general section (R313.1 General) gives us a place to put all the design and installation charging language and alleviates the need for repetitive language in each section.

Creating an addition and alteration section (R313.4 Additions and alterations) puts all the information in one place and alleviates the need for repetitive exception language in each section.

Adding an exception (R302.2 Townhouses) for a common 2 hour fire-resistive-rated wall assembly give the builders the option to increase the separation requirements between dwelling units to avoid the installation of fire sprinklers.

Adding the fire-resistive language for townhouses and one- and two-family dwellings gives the builder an option to meet higher construction standards for compartmentalization or the option to sprinkler the structures to reduce the construction ratings.

Ultimately this brings the IRC back to being more of a performance code verses a prescriptive code. Fire sprinklers have proven to be an effective active system for life safety as much as compartmentalization has proven to be an effective passive system for life safety. Giving the designer or builder the option to choose which system works best for their product is what we want the code to do.

Fire sprinklers for several jurisdictions are an effective alternative to mitigate other conditions that may exist, such as: inadequate or no fire flow, steeply sloping access roads or driveways, long dead-end roads or driveways and areas that have volunteer fire departments or longer response times. Giving the building official the ability to use an alternative means to mitigate extenuating circumstances in rural or difficult areas with fire sprinklers is a great tool to have at our disposal.

Requiring fire sprinklers as a one size fits all approach is not right for the IRC to do, that's like requiring all windows in a home to have fall protection regardless of its height above grade or size. The requirement of fire sprinklers should be based on a risk assessment profile that balances the variables mentioned, plus staffing levels, response times, apparatus types etc. This is a decision that needs to made at a local level where they have an understanding of their risk profile, not by a one size fits all national mandate.

The benefit of any code change needs to consider not only life saftey but cost as well. The expense of sprinklers cannot be ignored. According to NFPA and an article by Marshall Klein and Julius Ballanco, the cost of a residential sprinkler system can range from $0.05 – $ 3.66 per square foot. Both documents indicate "the typical installation will be closer to the middle or higher end of the price range". This is a significant cost, a 2400 sqft, 1 story home with a full basement, pricing could range from $8784.00 - $17568.00. Since 2009 many jurisdictions have been reluctant to adopt this requirement as written because is drives up the cost of building new homes. The jurisdictions that choose to adopt the sprinkler mandate may put themselves at a competitive disadvantage as homebuilders may choose to develop in areas that do not require the sprinklers.

I do not believe a home with:

- fire roads designed to the IFC for access,
- hydrants spaced as required by code,
- the ability to provide a required fire flow,
- homes spaced with the required fire separation distance,
- code required egress through doors and windows,
- protected means of egress by rating basement stairs and all floor assemblies,
- compartmentalization of garages and Dwellings,
- active warning systems like smoke and CO detectors, are unsafe and the over regulation of requiring fire sprinklers, will now make a home safe to occupy.

NFPA article:
http://www.firesprinklerinitiative.org/~/media/Fire%20Sprinkler%20Initiative/Files/Reports/FireSprinklerCostAssessment.pdf

P2904 article: http://www.ircfiresprinkler.org/docs/Klein-Ballanco%20Residential%20Sprinkler%20Design%20Made%20Easy%20-%20Plumbing%20Systems%20and%20Design%20Mag.%20Sept%202008.pdf

Cost Impact: None.

RB148-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.1 (NEW)-RB-ARCHER

RB149 – 13
R313.1.1

Proponent: Rita Neiderheiser, representing Road Sprinkler Fitters Local Union 669 (4ritan@gmail.com)

Revise as follows:

R313.1.1 Design and installation. Automatic residential fire sprinkler systems for townhouses shall be designed and installed in accordance with Section P2904 <u>or NFPA 13D.</u>

Reason: The current language is unclear as to whether National Fire Protection Association (NFPA) 13D designed and installed systems are allowed to be used in townhouses. Adding "NFPA 13D" to Section R313.1.1 will make it clear that either a NFPA 13D system or a system that complies with Section P2904 of the IRC may be installed in townhouses.

Cost Impact: The code change proposal will not increase the cost of construction.

RB149-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.1.1-RB-NEIDERHEISER

RB150 – 13
R313.1

Proponent: Kirk Nagle, City of Arvada, representing self (knagle@arvada.org)

Revise as follows:

R313.1 Townhouse automatic fire sprinkler systems. An automatic residential fire sprinkler system shall be installed in townhouses.

> **Exception:** An automatic residential fire sprinkler shall not be required when <u>a fire extinguisher has been installed in the kitchen and the separation for the townhouses is two 1-hour walls or a 2- hour common wall between units is provided or where</u> additions or alterations are made to existing townhouse that do not have an automatic residential fire sprinkler system installed.

Reason: Residential fire sprinkler systems are not accepted by all the state legislatures in single family homes and have been written out of the adoption process by 30 of the 50 states in the US. This creates a code issue with the way states use the code adoption process and has elected officials writing or rewriting the codes we use. We do not want the state legislative system to make the code adoption process useless if the states then rewrite or prevent the use of codes that are decided through the consensus process that the ICC uses to validate and promote the codes. The process currently used by the ICC is, in my opinion the best in the world. Sometimes there a codes that are approved and they need to be cared for. I believe that showing the state legislatures that we hear them and understand what happened is very important, I strongly believe that sprinklers have a place but should not be mandated.

Fire sprinklers, as good as they are, do not provide a substantial saving of lives when you add that we already have smoke alarms in all buildings and that we require fire alarms be put into each home even with a very small remodel. Smoke alarms have a 99.45% life safety rating and where adding a fire sprinker the, lifesaving rate only goes up to 99.87% as stated by the NFPA. The cost to have every new home put in fire sprinklers is very expensive and cost prohibitive in a fragile economy compared to the life safety that fire sprinkers will bring to building construction. Fire sprinklers should be voluntary for each home owner to choose, if they wich. Educating the public and state legislatures would be the first step to all-around acceptance. If we put fire sprinkilers in the code they need to be understood so the legislative actions taken against fire sprinklers can be reversed so the codes can be enforced as they were meant to be and not changed by elected officials. The prohibition of fire sprinklers has made some situations where fire sprinklers are needed impossible because of the legislative actions against their use and this is a huge problem in rural areas where there is little or no fire protection at all.

Adopting codes where the controversy is to volatile is not a good thing, but I do believe that leaving the code adoption up to the local jurisdictions is important, plus it promotes stronger codes. I am not, I repeat not, against fire sprinklers in any way. The interested parties with political clout in the US have spoken and we need to address their concerns by showing that we listen. Our process should not become a point of contention where there are attacks of the process outside the code hearings. I feel very strongly that in order to gain acceptance we need to show we will work to get fire sprinklers accepted by the public and state legislatures before we require them in one- and two-family homes. We have an obligation to make the codes strong and acceptable to the populations they will serve. If we have a problem with acceptance, we need to make corrections to the written code. We want the people and the elected officials to see the codes as not only the standard of safety, but realize that adoption is for their safety and the safety of others and the most cost effective way to protect people's lives.

Cost Impact: This proposal will decrease the cost of townhouse construction.

RB150-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.1-RB-NAGLE

RB151 – 13
R313.2

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Revise as follows:

R313.2 One- and two-family dwellings automatic fire systems. An automatic residential fire sprinkler system shall be installed in new *dwelling units* and new ~~one- and two-family~~ *dwellings*.

> **Exception:** An automatic residential fire sprinkler system shall not be required for *additions* or *alterations* to existing ~~buildings~~ *dwellings or dwelling units* that are not already provided with an automatic residential sprinkler system.

Reason: The 2009 IRC adopted fire sprinkler regulations that continue in the 2012 IRC. However upon implementation of the regulations it is apparent that an inconsistency appears in Section R313.2 when compared with Section R313.1. Section R313.1 in its exception exempts additions and alterations to townhouses that are not already protected with fire sprinklers. The exception does not exempt new townhouses added adjacent to existing townhouses from protection. Section R202 defines a townhouse as "**TOWNHOUSE.** A single-family *dwelling unit* constructed in a group…" and as a consequence R313.1 will require the new townhouse to be protected since it is a "single family dwelling unit".

Section R313.2 address a second configuration of dwelling that may be one dwelling or two attached dwelling units. It is not uncommon in more urban environments for a new dwelling unit to be added and attached to an existing dwelling and as a consequence the new dwelling unit should be protected as would a townhouse added adjacent to another townhouse dwelling unit.

The term building is not defined in the IRC and is not consistent with the heading of Section R313.2 and therefore the terms dwelling and dwelling unit are more appropriate.

Cost Impact: This code change will minimally increase the valuation of construction by less than 1 %.

RB151-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.2-RB-FATTAH

RB152 – 13
R313.2

Proponent: Kirk Nagle, City of Arvada, Co, representing self. (knagle@arvada.org)

Revise as follows:

R313.2 One and Two-family dwelling automatic fire systems. An automatic residential fire sprinkler system shall be installed in one-and two-family dwellings.

> **Exception:** An automatic residential fire sprinkler system shall not be required <u>where a fire extinguisher has been installed in the kitchen and the separation for a two-family dwelling is two 1-hour walls or a 2-hour common wall between units is provided or</u> for additions or alterations in existing buildings that are not already provided with an automatic residential sprinkler system.

Reason: Residential fire sprinkler systems are not accepted by all the state legislatures in single family homes and have been written out of the adoption process by 30 of the 50 states in the US. This creates a code issue with the way states use the code adoption process and has elected official s writing or rewriting the codes we use. We do not want the state legislative system to make the code adoption process useless if the states then rewrite or prevent the use of codes that are decided through the consensus process that the ICC uses to validate and promote the codes. The code process currently used by the ICC is, in my opinion the best in the world. Sometimes there3 are codes that are approved and they need to be changed but rarely has the code process been challenged on such a scale. The code is not infallible but the process needs to be protected and cared for. I believe that showing the states legislatures that we hear them and understand what happened is very important. I strongly believe that sprinklers have a place but should not be mandated.

Fire sprinklers, as good as they are, do not provide a substantial saving of lives when you add that we already have fire alarms in all buildings and that we require fire alarms be put into each home even with a very small remodel., Fire alarms have a 99.46% life safety rating and adding a fire sprinklers the lifesaving rate only goes up to 99.86%. The cost to have every new home put in fire sprinklers is very expensive and cost prohibitive in a fragile economy compared to the life safety that fire sprinklers will bring to building construction. Fire sprinklers should be voluntary for each home owner to choose, if they wish. Educating the public and state legislatures would be the first step to all around acceptance. If we put fire sprinklers in the code they need to be understood so the legislative actions taken against fire sprinklers can be reversed so the codes can be enforced as they were meant to be and not changed by elected officials. The prohibition of fire sprinklers has made some situations where fire sprinklers are needed impossible because of the legislative actions against their use and this is a huge problem in rural areas where there is little or no fire protection at all.

Adopting codes where the controversy is too volatile is not a good thing but I do believe that leaving the code adoption up to the local jurisdictions is important plus it promotes stronger codes. I am not I repeat not against fire sprinklers in any way. The interested parties with political clout in the US have spoken and we need to address their concerns by showing that we listen. Our process should not become a point of contention where there are attacks of the process outside the code hearings. I feel very strongly that in order to gain acceptance we need to show we will work to get fire sprinklers accepted by the public and state legislatures before we require them in one- and two-single family homes. We have an obligation to make codes strong and acceptable to the populations they will serve, if we have a problem with acceptance, we need to make corr4ections to the written code. We want the p0eople and the elected officials to see the codes as, not only the standard of safety but adoption is for their safety and the safety of others an d the most cost effective way to protect peoples lives.

Cost Impact: This code change will reduce the cost of one- and two-family dwelling construction.

RB152-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.2-RB-NAGEL

RB153 – 13
R313.2.1

Proponent: Tim Swanson, City of Greeley, representing Colorado Chapter of the International Code Council (tim.swanson@greeleygov.com)

Revise as follows:

R313.2.1 Design and installation. Automatic residential fire sprinkler systems shall be designed and installed in accordance with Section P2904. ~~or NFPA 13D.~~

Reason: The 2012 IRC specifies that the sprinkler system that is required by Section R313.1.1 for Townhouse applications comply with the requirements of P2904. In Section P2904.1, either the requirements of Section P2904, or the requirements of NFPA 13D are allowed for the installation of residential fire sprinklers. In Section R313.2.1, the code specifies that the NFPA 13D system may also be used. This is redundant, as it is already stated in P2904.1. It also does not mirror the language in 313.1.1, which could cause confusion, as both sections are addressing residential fire sprinkler applications required by the IRC. This change would now mirror IRC 313.1.1 and clear up any confusion and redundancy.

Cost Impact: None

RB153-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R313.2.1-RB-SWANSON

RB154 – 13
R314

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov), and Adolf Zubia, Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee

Delete and substitute as follows:

SECTION R314
SMOKE ALARMS

~~**R314.1 Smoke detection and notification.** All smoke alarms shall be listed and labeled in accordance with UL 217 and installed in accordance with the provisions of this code and the household fire warning *equipment* provisions of NFPA 72.~~

~~**R314.2 Smoke detection systems.** Household fire alarm systems installed in accordance with NFPA 72 that include smoke alarms, or a combination of smoke detector and audible notification device installed as required by this section for smoke alarms, shall be permitted. The household fire alarm system shall provide the same level of smoke detection and alarm as required by this section for smoke alarms. Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. The system shall be monitored by an *approved* supervising station and be maintained in accordance with NFPA 72.~~

~~**Exception:** Where smoke alarms are provided meeting the requirements of Section R314.4.~~

~~**R314.3 Location.** Smoke alarms shall be installed in the following locations:~~

1. ~~In each sleeping room.~~
2. ~~Outside each separate sleeping area in the immediate vicinity of the bedrooms.~~
3. ~~On each additional *story* of the *dwelling*, including *basements* and habitable attics but not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.~~

~~**R314.3.1 Alterations, repairs and additions.** When *alterations*, repairs or *additions* requiring a *permit* occur, or when one or more sleeping rooms are added or created in existing *dwellings*, the individual *dwelling unit* shall be~~
~~equipped with smoke alarms located as required for new *dwellings*.~~

~~**Exceptions:**~~

1. ~~Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, or the *addition* or replacement of windows or doors, or the *addition* of a porch or deck, are exempt from the requirements of this section.~~
2. ~~Installation, *alteration* or repairs of plumbing or mechanical systems are exempt from the requirements of this section.~~

~~**R314.4 Power source.** Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.~~

~~**Exceptions:**~~

1. ~~Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power.~~
2. ~~Hard wiring of smoke alarms in existing areas shall not be required where the *alterations* or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an *attic*, crawl space or *basement* available which could provide access for hard wiring without the removal of interior finishes.~~

~~**R314.5 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.~~

~~**Exception:** Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.~~

R314.1 General. Smoke alarms shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be listed in accordance with UL 217. Combination smoke/carbon monoxide alarms shall be listed in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in dwelling units.

R314.2.2 Alterations, repairs and additions. When alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings.

Exceptions:

1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, are exempt from the requirements of this section.
2. Installation, alteration or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional *story* of the *dwelling*, including *basements* and habitable attics but not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.

R314.5 Combination alarms. Combination smoke/carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms.

R314.6 Power source. Smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R315.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning *equipment* provisions of NFPA 72. Smoke detectors shall be listed in accordance with UL 268.

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner and shall be monitored by an approved supervising station.

R314.7.4 Combination detectors. Combination smoke/carbon monoxide detectors shall be permitted to be installed in fire alarm systems in lieu of smoke detectors, provided they are listed in accordance with UL 268 and UL 2075.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Fire Code Action Committee (FCAC). These ICC committees were established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the these committees have held 6 open meetings and numerous workgroup meetings which included members of the committees as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the CAC website at: http://www.iccsafe.org/cs/CAC/Pages/default.aspx.

This proposal reformats the Section R314 smoke alarm requirements in a more logical order. It is not the intent of this proposal to increase or lessen the overall smoke alarm requirements. The format for this section is similar to one used on a companion proposal to the Section R315 carbon monoxide alarm requirements. Comments on the origin of specific requirements in this proposal are as follows:

1. R314.1 is a new simplified charging paragraph for the section. The UL 217 Listing requirement was moved to R314.1.1. The reference to NFPA 72 was moved to R314.7.1.
2. R314.1.1 includes new provisions to allow combination smoke/carbon monoxide alarms, if they are provided, to be listed in accordance with UL 217 and UL 2034.
3. R314.2 includes requirements for new construction and alterations and repairs. The section includes editorial revisions, but no substantive changes to existing requirements. R314.2.1 requirements are identical to existing R314.3.1 requirements.
4. The R314.3 location requirements are unchanged.
5. R314.4 requirements for interconnection are identical to the existing requirements in R314.5.
6. R314.5 allows listed combination smoke/carbon monoxide alarms to be used in lieu of smoke alarms. A companion change to allow these units to be used in lieu of carbon monoxide alarms is also being proposed for Section R315. If both

of these proposals are accepted, a single combination unit can be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms and comply with R314 and R315 requirements.

7. R314.6 includes power supply requirements that are equivalent to the current power supply requirements in R314.4. There should be no changes for the applications under which permanently connected or battery operated smoke alarms are required.
8. R314.7 includes revised requirements for smoke detection systems. Sections R314.7.1 through R314.7.3 include requirements that are equivalent to existing R314.2 requirements.
9. R314.7.4 includes new requirements that allow the option to use combination smoke/carbon monoxide detectors.

Cost Impact: These revisions have the potential to reduce the cost of construction.

RB154-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.1-RB-BAJNAI-ZUBIA-BCAC

RB155 – 13
R314.2, R315.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov), and Adolf Zubia, Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee

Revise as follows:

R314.2 Smoke detection systems. Household fire alarm systems installed in accordance with NFPA 72 that include smoke alarms, or a combination of smoke detector and audible notification device installed as required by this section for smoke alarms, shall be permitted. The household fire alarm system shall provide the same level of smoke detection and alarm as required by this section for smoke alarms. Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. ~~The system shall be monitored by an approved supervising station and be maintained in accordance with NFPA 72.~~

Exception: Where smoke alarms are provided meeting the requirements of Section R314.4.

R315.2 Carbon monoxide detection systems. Carbon monoxide detection systems that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720, shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075. Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy~~,~~ <u>and</u> owned by the homeowner. ~~and shall be monitored by an approved supervising station.~~

Exception: Where carbon monoxide alarms are installed meeting the requirements of Section R315.1, compliance with Section 315.2 is not required.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Fire Code Action Committee (FCAC). These ICC committees were established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the these committees have held 6 open meetings and numerous workgroup meetings which included members of the committees as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the CAC website at: http://www.iccsafe.org/cs/CAC/Pages/default.aspx.

The code requires smoke alarms and carbon monoxide alarms to be installed in the dwelling, or allows smoke detection systems and carbon monoxide detection systems to be provided in lieu of individual alarms to provide the desired protection. These systems need to be a permanent fixture of the occupancy and owned by the homeowner. This is because the systems could be leased to the homeowner by an alarm company. If the homeowner discontinued service with the alarm company there is nothing to prevent them from removing the system from the premise. Then the home would be left with no protection.

It is difficult to justify requiring these systems to be monitored by an approved supervising station, as long as they provide local alarm notification. In addition Section 907.7.5 does not require monitoring of an automatic sprinkler system in one- and two-family dwellings. However there is nothing that prohibits these systems from being monitored.

In addition the reference in R314.2 to systems being maintained in accordance with NFPA 72 is being removed since the scope of the IRC does not cover maintenance of systems.

Cost Impact: The proposal has the potential to reduce costs.

RB155-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.2-RB-BAJNAI-ZUBIZ-BCAC

RB156 – 13
R314.3.1 (New) and R314.3.2 (New)

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov), and Adolf Zubia, Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee

Add new text as follows:

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6.1 m) horizontally from a permanently installed cooking appliance.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3 m) horizontally from a permanently installed cooking appliance.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1.8 m) horizontally from a permanently installed cooking appliance.

R314.3.2 Installation near bathrooms. Smoke alarms shall be installed not less than 3 feet (0.91 m) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by Section R314.3.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Fire Code Action Committee (FCAC). These ICC committees were established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the these committees have held 6 open meetings and numerous workgroup meetings which included members of the committees as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the CAC website at: http://www.iccsafe.org/cs/CAC/Pages/default.aspx

This proposal is intended to reduce nuisance alarms attributed to locating smoke alarms in close proximity to cooking appliances and bathrooms in which steam is produced. The proposed provisions are based on the findings in the Task Group Report - Minimum Performance Requirements for Smoke Alarm Detection Technology - February 22, 2008, and are consistent with similar requirements included in Section 29.8.3.4 of the 2010 and 2013 editions of NFPA 72.

Cost Impact: None.

RB156-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.3.1 (NEW)-RB-BAJNAI-ZUBIA

RB157 – 13
R314.3.1

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R314.3.1 Alterations, repairs and additions. When *alterations*, repairs or *additions* requiring a *permit* occur, or when one or more sleeping rooms are added or created in existing *dwellings*, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

~~1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, or the *addition* or replacement of windows or doors, or the *addition* of a porch or deck, are exempt from the requirements of this section.~~
~~2. Installation, *alteration* or repairs of plumbing or mechanical systems are exempt from the requirements of this section.~~
1. Addition, replacement or repair of windows or doors.
2. Replacement or repair of roofing, siding, masonry, stucco, or other exterior surfaces.
3. Additions of or repairs to porches, decks, or balconies.
4. Work involving detached accessory structures.
5. Installation of retaining walls or fences.
6. Installation, repair, or alteration of plumbing, mechanical, or electrical systems that occurs on the exterior of the dwelling or in an accessory structure.
7. Installation, alteration or repairs of plumbing or mechanical systems within a dwelling unit.

Reason: It is necessary to more definitively identify those circumstances when smoke alarms are not required when alterations, repairs and additions occur because of confusion within the code enforcement community over the current language. The same revision is proposed for the CO alarm section.

For example, if smoke alarms need not be installed when a home is reroofed, are they required when someone builds a storage shed in their back yard? Current language does not seem to exempt such work.

Cost Impact: None

RB157-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.3.1-RB-DAVIDSON

RB158 – 13
R314.3.1

Proponent: Tim Pate, City and County of Broomfield, CO representing the Colorado Chapter Code Change Committee

Revise as follows:

R314.3.1 Alterations, repairs and additions. When alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings.

Exceptions:

1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, ~~or the addition~~ or replacement of ~~windows or~~ doors, or the addition of a porch or deck, are exempt from the requirements of this section.
2. Installation, *alteration* or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

Reason: This code change will effectively require that smoke alarms be installed for all permits for window changeouts and for permits to add windows or doors. These two types of permits actually require part of the work to be done on both the exterior and the interior and therefore should be classified as an interior alteration. Adding smoke alarms to existing houses is a relatively inexpensive task considering that section R314 for the most part allows these smoke alarms to be battery operated. There is considerable evidence that houses with smoke alarms save lives in the cases of fire.

Cost Impact: This code change will increase the cost of construction.

RB158-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.3.1-RB-PATE

RB159 – 13
R314.5 (New)

Proponent: Thomas P. Hammerberg, representing Automatic Fire Alarm Association (TomHammerberg@afaa.org)

Add new text as follows:

R314.5. Residential Sprinkler Monitoring. Where a Residential Sprinkler System is installed, a sprinkler waterflow alarm-initiating device shall be permitted to be connected to the multiple-station alarm or household fire alarm system to activate an alarm signal.

Reason: This language is currently used in NFPA-72-2013, 29.7.7.7.3. The purpose is to provide notification to occupants of waterflow activation. If a sprinkler activates in another part of the dwelling unit, this provides earlier warning of the fire situation and will allow additional time to leave the premises. Since the time to escape has reduced significantly in recent years, this will improve fire safety for the occupants.

Cost Impact: Minimal

RB159-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R314.5 (NEW)-RB-HAMMERBERG

RB160 – 13
R315

Proponent: Charles S. Bajnai, Chesterfield County, VA, ICC Building Code Action Committee (bajnaic@chesterfield.gov), and Adolf Zubia, Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee

Delete and substitute as follows:

SECTION R315
CARBON MONOXIDE ALARMS

~~**R315.1 Carbon monoxide alarms.** For new construction, an approved carbon monoxide alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in *dwelling units* within which fuel-fired *appliances* are installed and in dwelling units that have attached garages.~~

~~**R315.2 Carbon monoxide detection systems.** Carbon monoxide detection systems that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720, shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075. Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner and shall be monitored by an approved supervising station.~~

> ~~**Exception:** Where carbon monoxide alarms are installed meeting the requirements of Section R315.1, compliance with Section 315.2 is not required.~~

~~**R315.3 Where required in existing dwellings.** Where work requiring a *permit* occurs in existing *dwellings* that have attached garages or in existing dwellings within which fuelfired *appliances* exist, carbon monoxide alarms shall be provided in accordance with Section R315.1.~~

~~**R315.4 Alarm requirements.** Single-station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.~~

R315.1 General. Carbon monoxide alarms shall comply with Section R315.

R315.1.1 Listings. Carbon monoxide alarms shall be listed in accordance with UL 2034. Combination carbon monoxide/smoke alarms shall be listed in accordance with UL 2034 and UL 217.

R315.2 Where required. Carbon monoxide alarms shall be provided in accordance with this section.

R315.2.1 New construction. Carbon monoxide alarms shall be provided in dwelling units when either or both of the following conditions exist.

1. The dwelling unit contains a fuel-fired appliance.
2. The dwelling unit has an attached garage with an opening that communicates with the dwelling unit.

R315.2.2 Alterations, repairs and additions. When alterations, repairs or additions requiring a permit occur, or when one or more sleeping rooms are added or created in existing dwellings, the individual dwelling unit shall be equipped with carbon monoxide alarms located as required for new dwellings.

Exceptions:

1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, are exempt from the requirements of this section.
2. Installation, alteration or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

R315.3 Location. Carbon monoxide alarms in dwelling units shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms. When a fuel-burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

R315.4 Combination alarms. Combination carbon monoxide/smoke alarms shall be permitted to be used in lieu of carbon monoxide alarms.

R315.5 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Carbon monoxide alarms shall be permitted to be battery operated when installed in buildings without commercial power.
2. Carbon monoxide alarms installed in accordance with Section R315.2.2 shall be permitted to be battery powered.

R315.6 Carbon monoxide detection systems. Carbon monoxide detection systems shall be permitted to be used in lieu of carbon monoxide alarms and shall comply with Sections R315.6.1 to R315.6.4.

R315.6.1 General. Household carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

R315.6.2 Location. Carbon monoxide detectors shall be installed in the locations specified in Section R315.3. These locations supersede the locations specified in NFPA 720.

R315.6.3 Permanent fixture. Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner and shall be monitored by an approved supervising station.

R315.6.4 Combination detectors. Combination carbon monoxide/smoke detectors shall be permitted to be installed in carbon monoxide detection systems in lieu of carbon monoxide detectors, provided they are listed in accordance with UL 2075 and UL 268.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Fire Code Action Committee (FCAC). These ICC committees were established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the these committees have held 6 open meetings and numerous workgroup meetings which included members of the committees as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the CAC website at: http://www.iccsafe.org/cs/CAC/Pages/default.aspx.

This proposal clarifies requirements for the installation of CO alarm and CO detection systems as follows:

1. Section R315 was reorganized to provide requirements in a more logical location. Except as noted below no technical changes were made to the existing requirements.
2. Listed combination carbon monoxide/smoke alarms, and combination carbon monoxide /smoke detectors are readily available on the market. This proposal identifies the UL standards used to List these products, and allows them to be used in lieu of carbon monoxide alarms and detectors. A companion change to allow these units to be used in lieu of

smoke alarms and smoke detectors is being proposed for Section R314. If both of these proposals are accepted, a single combination unit can be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms and comply with R314.3 (2) and R315.3 (above).

3. Current Section R315.1 requires carbon monoxide alarms to be provided in dwelling units with attached garages. Carbon monoxide is most likely to enter a dwelling from an attached garage if there is a communicating opening between the garage and dwelling. Some homes with attached garages do not have a communicating opening. Accordingly, proposed Section R315.2.1, item 2, only requires carbon monoxide alarms when the dwelling unit has an attached garage with an opening that communicates with the dwelling unit.
4. Current Section R315.3 requires CO alarms to be installed in existing dwellings whenever any kind of work that requires a permit is conducted, such as reroofing or adding a deck. Proposed section R315.2.2 reflects the more realistic requirements for providing carbon monoxide alarms in existing dwelling units to match the triggers used to require smoke alarms in existing dwelling units that are included in Section R314.3.1. In addition Section R315.5(2) only requires these alarms to be battery powered.
5. The IRC allows fuel burning appliances to be installed in bedrooms and bathrooms, but this is not a common practice. Section R315.3 requires carbon monoxide alarms to be installed in a bedroom when it or its attached bathroom contains a fuel burning appliance. This protects occupants who sleep with their bedroom door closed.
6. R315.5 clarifies the requirements for powering CO alarms that is consistent with R314.4 smoke alarm requirements.
7. The carbon monoxide detection system requirements have been moved from Section R315.2 to proposed Sections R315.6 through R315.6.2. The basic requirements for these systems are unchanged, but additional language was added to clarify that:
    a. These systems can be used in lieu of carbon monoxide alarms.
    b. All devices and equipment in the system must be listed for their intended purpose (see NFPA 720, section 9.3.1)
    c. Combination carbon monoxide/smoke detectors can be used.
    d. Detectors only need to be installed in locations specified in section R315.3, not in all locations specified in NFPA 720.

The code requires smoke alarms and carbon monoxide alarms to be installed in the dwelling, but allows smoke detection systems and carbon monoxide detection systems to be provided in lieu of individual alarms to provide the desired protection. These systems need to be a permanent fixture of the occupancy and owned by the homeowner. This is because the systems could be leased to the homeowner by an alarm company. If the homeowner discontinued service with the alarm company there is nothing to prevent them from removing the system from the premise. Then the home would be left with no protection.

It is difficult to justify requiring these systems to be monitored by an approved supervising station, provided they provide local alarm notification. In addition Section 907.7.5 does not require monitoring of an automatic sprinkler system in one- and two-family dwellings. However there is nothing that prohibits these systems from being monitored.

In addition the reference in R314.2 to systems being maintained in accordance with NFPA 72 is being removed since the scope of the IRC does not cover maintenance of systems.

Cost Impact: These revisions have the potential to reduce the cost of construction.

RB160-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R315.1-RB-BAJNAI-ZUBIA-BCAC

RB161 – 13
R315.3

Proponent: Jerry Anderson, City of Overland Park, Ks, representing self (jerry.anderson@opkansas.org)

Revise as follows:

R315.3 Where required in existing dwellings. Where work requiring a permit occurs in existing dwellings that have attached garages or in existing dwellings within which fuel fired appliances exist, carbon monoxide alarms shall be provided in accordance with Section R315.1.

<u>**Exceptions:**</u>

1. <u>Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, are exempt from the requirements of this section.</u>
2. <u>Installation, alteration or repairs of plumbing or mechanical systems are exempt from the requirements of this section.</u>

Reason: The purpose of the code change is to exempt some minor work from triggering carbon monoxide detectors. The exceptions to the base requirement for installing carbon monoxide detectors in existing dwellings are exactly the same as found in section R314.3.1 for smoke detectors. This change will make the code consistent in its approach in providing early warning detection devices in dwellings. It is unreasonable require the installation of carbon monoxide detectors for any work that is done on an existing dwelling.

Cost Impact: No cost associated with this change

RB161-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R315.3-RB-ANDERSON

RB162 – 13
R315.3

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R315.3 Where required in existing dwellings. Where work requiring a *permit* occurs in an existing *dwelling~~s~~* that ~~have~~ has an attached garage~~s~~ or in an existing dwelling~~s~~ within which fuel fired *appliances* exist, carbon monoxide alarms shall be provided in accordance with Section R315.1.

Exceptions:

1. Addition, replacement or repair of windows or doors.
2. Replacement or repair of roofing, siding, masonry, stucco, or other exterior surfaces.
3. Additions of or repairs to porches, decks, or balconies.
4. Work involving detached accessory structures.
5. Installation of retaining walls or fences.
6. Installation, repair, or alteration of plumbing, mechanical, or electrical systems that occurs on the exterior of the dwelling or in an accessory structure.
7. Installation, alteration, or repairs of plumbing, mechanical, or electrical systems not involving a fuel fired appliance.

Reason: Given the low number of deaths caused by CO poisoning compared to injuries and deaths caused by falls, fires, and other household accidents, the current rules regarding CO alarms are overly restrictive. Without exception, the code requires CO alarms be installed in a dwelling even when a permit is issued for a such mundane exterior work as retaining wall! This means homeowners must provide access to the interior of their homes to contractors and inspectors to install and inspect CO alarms (but not smoke alarms). Bluntly, this is ridiculous. The proposed revisions create a number of exceptions when CO alarms need not be installed. Unless some relief is given for exterior and other work that does not involve directly the ability to install CO alarms, permits will never get final inspections completed in a timely manner and building departments will be faced with a huge backlog of open permits.

Some folks will argue that the text says CO alarms are only required when work occurs "in" existing dwellings meaning exterior work is exempt. I might agree except the language used for CO alarms is the same used for smoke alarms and we seem to agree, based on exceptions in the code, that exterior work would trigger the smoke alarm requirements unless we have the exceptions. So if the text means one thing in one section, we conclude the same text means the same thing in another section.

R314.3.1 Alterations, repairs and additions. When *alterations*, repairs or *additions* requiring a *permit* occur, or when one or more sleeping rooms are added or created in existing *dwellings*, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, or the *addition* or replacement of windows or

Cost Impact: None

RB162-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R315.3-RB-DAVIDSON

RB163 – 13
R316.3

Proponent: Vytenis Babrauskas, PhD, Fire Science & Technology Inc., representing The American Institute of Architects, Cascadia Green Building Council, Development Center for Appropriate Technology, Green Science Policy Institute, Hammond Fine Homes, International Living Future Institute, Perkins + Will, San Francisco Firefighters Cancer Prevention Foundation and the United States Green Building Council of California

Revise as follows:

R316.3 Surface burning characteristics. Unless otherwise allowed in R316.5 or 316.6, all foam plastic or foam plastic cores used as a component in manufactured assemblies used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose-fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

~~Exception~~ <u>Exceptions:</u>

<u>1.</u> Foam plastic insulation more than 4 inches (102 mm) thick shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is *approved* in accordance with Sections R316.6 using the thickness and density intended for use.
<u>2. Foam plastic insulation shall not be subject to this requirement where installed with a thermal barrier in accordance with Section R316.4.</u>

Reason: This proposal addresses a material performance requirement currently in the code which is not supported by available evidence from fire science research. Removal of the performance requirement as proposed would provide choice for manufacturers and consumers by allowing foam plastic insulation materials without flame retardants to be used in compliance with the code in a fire safe way. This would result in a healthier product at a lower cost.

The proposed change considers fire safety, public health, fire fighter and emergency responder safety, and energy efficiency. It is not a tradeoff among them, and improves them in many ways relevant to the current code requirements as described below and in the Substantiation Section.

For applications in which foam plastics are required to meet flame spread and smoke developed requirements of R316.3 and to be separated from interior spaces by an approved thermal barrier per R316.4, research and testing conducted over many years demonstrate the following:

It is the approved thermal barrier and the fireblocking required by the code that provide the fire safety related to foam plastic insulation, not its meeting the required flame spread and smoke developed ratings of R316.3. Even when foam plastic insulation meets the requirements of R316.3, if it is not protected by a thermal barrier it still poses an unacceptable level of fire hazard (Babrauskas et al., 2012).

In order to meet the flame spread and smoke developed requirements of R316.3, flame retardant chemicals are added to foam plastic insulations.

The two most common flame retardants used, hexabromocyclododecane (HBCD or HBCDD) and Tris (1-chloro-2-propyl) phosphate (TCPP), add potential risks throughout the product life cycle. These include environmental pollution, fire toxicity and possible adverse health effects for building occupants, fire service professionals, and the general public (Babrauskas et al., 2012). These chemicals are added only to meet flame spread and smoke developed requirements; they do not prevent foam plastics from burning.

Thermal barriers prevent temperature rise and adequately protect foam plastic insulation from igniting during a fire. Fire statistics show very few fires, no fire deaths and very few injuries attributable to fire started or spread by insulation within structural areas (Ahrens, 2011).

A precedent for a similar approach exists in Sweden where foam plastic insulation without flame retardants is used with code mandated protection by fire safe materials and construction (Blomqvist, McNamee, & Thureson, 2011; Lassen, Maag, Høibye, Vesterlykke, & Lundegaard, 2011; POPRC, 2011; Posner, Roos, & Olsson, 2010). Since the transition to non-flame retardant foam, there has been no detrimental impact on fire safety statistics in Sweden (Harrami & McIntyre, 2006; Lundqvist, McIntyre, & Hedman, 2008; Remberger et al., 2004).

In light of the available evidence, changing the code as proposed could:

-reduce and prevent harm from flame retardants without resulting in a reduction in fire safety,
-better align with the intent of the codes to establish "minimum requirements to safeguard the public safety, health and general welfare" and to provide "safety to fire fighters and emergency responders during emergency operations (R101.3)," and
-increase use of foam plastic insulations which are important for building energy efficiency by decreasing cost and by allowing flame-retardant free materials to be used in a code-compliant way for those concerned about flame retardant chemicals.

Substantiation: A thermal barrier meets the criteria of NFPA 275 by preventing the energy of a fire from reaching the foam. Specifically, NFPA 275 states that after 15 minutes of a post-flashover fire, the temperature at the interface of the thermal barrier and foam cannot exceed 121°C average with 163°C at one peak value thermocouple. This is substantially below the auto-ignition temperature of plastic foams, which are in excess of 400°C for polystyrene and polyurethane (Babrauskas, 2003).

Due to protection by thermal barriers, fire statistics show that insulation very rarely starts or spreads home fires. Insulation within a structural area was the item first ignited in 2% of US home structure fires, resulting in 10 civilian deaths and 90 civilian injuries (0% and 1% of the death and injury totals for the whole US, respectively). Insulation within a structural area was the primary item contributing to flame spread in 2% of US home structure fires, resulting in 0 civilian deaths and 40 injuries (0% and 1% of the death and injury totals for the whole US, respectively) (Ahrens, 2011).

HBCD and TCPP are added to foam plastics to meet flame spread and smoke developed requirements. 90% percent of HBCD and 86% of TCPP produced is used for building insulation (EC, 2008; Env Can, 2012; US EPA, 2010). Both chemicals are now widespread global contaminants (Covaci et al., 2006; Marvin et al., 2011; Van der Veen & de Boer, 2012). The presence of flame retardant chemicals can significantly increase the toxicity of fires when materials burn (Stec & Hull, 2011). Materials with flame retardants can produce greater amounts of carbon monoxide, smoke, and soot, compared to non-flame retardant materials (Babrauskas, 1992; Purser, 2000; Schnipper, Smith-Hansen, & Thomsen, 1995; Wichman, 2003). When HBCD burns, it produces dioxins, which are potentially carcinogenic (Birnbaum, Staskal, & Diliberto, 2003; Desmet, Schelfaut, & Sandra, 2005; Ebert & Bahadir, 2003). Firefighters have higher rates of cancers associated with dioxin exposure (IARC, 2010; LeMasters et al., 2006).

Canada and the European Union have scheduled HBCD to be phased out in the next 3-4 years (EC, 2011; Env Can, 2012). The US Environmental Protection Agency states that the chemical is

> "…persistent in the environment, bioaccumulative in living organisms, and highly toxic to aquatic organisms."
> and
> "Human exposure is evidenced by the presence of HBCD in breast milk, adipose tissue, and blood, and it biomagnifies in the food chain. HBCD presents human health concerns based on animal test results indicating potential reproductive, developmental, and neurological effects. People may be exposed to HBCD from products and dust in the home and workplace, as well as its presence in the environment."
> (US EPA, 2012)

Less is known about TCPP but concerns include its persistence in the environment, human exposure, and the potential to cause cancer (Van der Veen & De Boer, 2012).

Sweden uses the Eurocode classification system to rate the combustibility of building components including foam plastic insulation. Foam plastics are classified as combustible, and thus building codes specify how these materials can be used in fire safe ways, such as behind thermal barriers, concrete or masonry, and with other construction techniques (Blomqvist et al., 2011; Lassen et al., 2011; POPRC, 2011; Posner et al., 2010). Since non-flame retardant foam plastics have been used in Sweden, building fires and deaths from building fires have not increased, indicating that fire safety is maintained by the code mandated measures (Harrami & McIntyre, 2006; Lundqvist et al., 2008; Remberger et al., 2004).

From IRC Section R101.3 Intent:

> The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.
>
> From IRC Section R316.4 Thermal Barrier:
> Unless otherwise allowed in Section R316.5 or Section R316.6, foam plastic shall be separated from the interior of a building by an *approved* thermal barrier of minimum 1/2 inch (12.7 mm) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

Bibliography:

Links to the following research reports, and other supporting documentation are available for viewing and download at: http://saferinsulation.greensciencepolicy.org/code-change-proposal/

Ahrens, M. (2011). Home structure fires. Quincy, MA: National Fire Protection Association.
Babrauskas, V. (1992). Plastics, part B, The effect of FR agents on polymer performance. In V. Babrauskas & S. J. Grayson (Eds.), *Heat release in fires* (pp. 423–46). London: Elsevier Applied Science Publishers.
Babrauskas, V. (2003). *Ignition Handbook*. Issaqah, WA: Fire Science Publishers and Society of Fire Protection Engineers.
Babrauskas, V., Lucas, D., Eisenberg, D., Singla, V., Dedeo, M., & Blum, A. (2012). Flame retardants in building insulation: a case for re-evaluating building codes. *Building Research & Information*, *40*(6), 738–755. doi:10.1080/09613218.2012.744533
Birnbaum, L. S., Staskal, D. F., & Diliberto, J. J. (2003). Health effects of polybrominated dibenzo-p-dioxins (PBDDs) and dibenzofurans (PBDFs). *Environment international*, *29*(6), 855–60. doi:10.1016/S0160-4120(03)00106-5
Blomqvist, P., McNamee, M. S., & Thureson, P. (2011). Compilation of International Building Regulations (Fire) Relevant for EPS/XPS: SP Technical Note 2010:10, revised 2011-11-30. Borås, Sweden: SP Technical Insitute.
Covaci, A., Gerecke, A. C., Law, R. J., Voorspoels, S., Kohler, M., Heeb, N. V, Leslie, H., et al. (2006). Hexabromocyclododecanes (HBCDs) in the environment and humans: a review. *Environmental science & technology*, *40*(12), 3679–88.
Desmet, K., Schelfaut, M., & Sandra, P. (2005). Determination of bromophenols as dioxin precursors in combustion gases of fire retarded extruded polystyrene by sorptive sampling-capillary gas chromatography–mass spectrometry. *Journal of Chromatography A*, *1071*(1-2), 125–129. doi:10.1016/j.chroma.2004.12.019
Ebert, J., & Bahadir, M. (2003). Formation of PBDD/F from flame-retarded plastic materials under thermal stress. *Environment international*, *29*(6), 711–6. doi:10.1016/S0160-4120(03)00117-X
EC. (2008). European Union Risk Assessment Report: Tris (2-Chloro-1-methylethyl) phosphate TCPP. Luxembourg: European Commission, Ireland Chemicals Policy and Services.
EC. (2011). Commission Regulation (EU) No 143/2011 of 17 February 2011. *Official Journal of the European Union*, *L44*(54), 2–6.
Env Can. (2012). Proposed Risk Management Measure for Hexabromocyclododecane (HBCD). Gatineau. Quebec: Environment Canada, Health Canada, Chemicals Management Division.

Harrami, O., & McIntyre, C. (2006). Fire and fire protection in homes and public buildings: An analysis of Swedish fire statistics. Stockholm, Sweden: Swedish Chemicals Inspectorate (KEMI).
IARC. (2010). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: FIREFIGHTING. Lyon: International Agency for Research on Cancer.
Lassen, C., Maag, J., Høibye, L., Vesterlykke, M., & Lundegaard, T. (2011). Alternatives to the use of flame retarded EPS in buildings. Oslo, Norway: Norwegian Climate and Pollution Agency (KLIF) and COWI A/S.
LeMasters, G. K., Genaidy, A. M., Succop, P., Deddens, J., Sobeih, T., Barriera-Viruet, H., Dunning, K., et al. (2006). Cancer risk among firefighters: a review and meta-analysis of 32 studies. *Journal of occupational and environmental medicine / American College of Occupational and Environmental Medicine*, *48*(11), 1189–202.
Lundqvist, M., McIntyre, C., & Hedman, U. (2008). The Swedish Rescue Services in Figures. Karlstad, Sweden: Swedish Civil Contingencies Agency (MSB).
Marvin, C. H., Tomy, G. T., Armitage, J. M., Arnot, J. A., McCarty, L., Covaci, A., & Palace, V. (2011). Hexabromocyclododecane: current understanding of chemistry, environmental fate and toxicology and implications for global management. *Environmental science & technology*, *45*(20), 8613–23.
POPRC. (2011). UNEP/POPS/POPRC.7/19/Add.1 Addendum: Risk management evaluation on hexabromocyclododecane. Geneva, Switzerland: United Nations Environment Programme Persistent Organic Pollutants Review Committee.
Posner, S., Roos, S., & Olsson, E. (2010). Exploration of Management options for HBCD. Molndal, Sweden: Swerea IVF.
Purser, D. A. (2000). The performance of fire retardants in relation to toxicity, toxic hazard, and risk in fires. In A. Grand & C. Wilkie (Eds.), *Fire retardancy of polymeric materials.* (pp. 449–99). New York: Marcel Dekker, Inc.
Remberger, M., Sternbeck, J., Palm, A., Kaj, L., Strömberg, K., & Brorström-Lundén, E. (2004). The environmental occurrence of hexabromocyclododecane in Sweden. *Chemosphere*, *54*(1), 9–21. doi:10.1016/S0045-6535(03)00758-6
Schnipper, A., Smith-Hansen, L., & Thomsen, E. S. (1995). Reduced combustion efficiency of chlorinated compounds, resulting in higher yields of carbon monoxide. *Fire and Materials*, *19*(2), 61–64.
Stec, A. A., & Hull, T. R. (2011). Assessment of the fire toxicity of building insulation materials. *Energy and Buildings*, *43*(2-3), 498–506. doi:10.1016/j.enbuild.2010.10.015
US EPA. (2010). Hexabromocyclododecane (HBCD) action Plan. US Environmental Protection Agency.
US EPA. (2012). Partnership on Flame Retardant Alternatives for Hexabromocyclododecane (HBCD). Retrieved December 16, 2012, from http://www.epa.gov/dfe/pubs/projects/hbcd/index.htm
Van der Veen, I., & De Boer, J. (2012). Phosphorus flame retardants: Properties, production, environmental occurrence, toxicity and analysis. *Chemosphere*, *88*(10), 1119–53.
Wichman, I. S. (2003). Material flammability, combustion, toxicity and fire hazard in transportation. *Progress in Energy and Combustion Science*, *29*(3), 247–299.

Cost Impact: The code change proposal will not increase the cost of construction.

RB163-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.3 #1-RB-BABRAUSKAS

RB164 – 13
R316.3

Proponent: Vytenis Babrauskas, PhD, Fire Science & Technology Inc., representing The American Institute of Architects, Cascadia Green Building Council, Development Center for Appropriate Technology, Green Science Policy Institute, Hammond Fine Homes, International Living Future Institute, Perkins + Will, San Francisco Firefighters Cancer Prevention Foundation, the United States Green Building Council of California

Revise as follows:

R316.3 Surface burning characteristics. Unless otherwise allowed in R316.5 or 316.6, all foam plastic or foam plastic cores used as a component in manufactured assemblies used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose-fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

~~Exception~~ Exceptions:

1. Foam plastic insulation more than 4 inches (102 mm) thick shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is *approved* in accordance with Sections R316.6 using the thickness and density intended for use.
2. Foam plastic insulation shall not be subject to this requirement when used in a wall, floor, foundation or roof assembly where the foam plastic insulation is separated from the interior of the building by a minimum 1-inch (25 mm) thickness of masonry or concrete.

Reason: This proposal addresses a material performance requirement currently in the code which is not supported by available evidence from fire science research. Removal of the performance requirement as proposed would provide choice for manufacturers and consumers by allowing foam plastic insulation materials without flame retardants to be used in compliance with the code in a fire safe way. This would result in a healthier product at a lower cost.

The proposed change considers fire safety, public health, fire fighter and emergency responder safety, and energy efficiency. It is not a tradeoff among them, and improves them in many ways relevant to the current code requirements as described below and in the Substantiation Section.

For applications in which foam plastics are required to meet flame spread and smoke developed requirements of R316.3 and to be separated from interior spaces by an approved thermal barrier per R316.4, research and testing conducted over many years demonstrate the following:

It is the thermal barrier and the fireblocking required by the code that provide the fire safety related to foam plastic insulation, not its meeting the required flame spread and smoke developed ratings of R316.3. Even when foam plastic insulation meets the requirements of R316.3, if it is not protected by a thermal barrier it still poses an unacceptable level of fire hazard (Babrauskas et al., 2012).

In order to meet the flame spread and smoke developed requirements of R316.3, flame retardant chemicals are added to foam plastic insulations.

The two most common flame retardants used, hexabromocyclododecane (HBCD or HBCDD) and Tris (1-chloro-2-propyl) phosphate (TCPP), add potential risks throughout the product life cycle. These include environmental pollution, fire toxicity and possible adverse health effects for building occupants, fire service professionals, and the general public (Babrauskas et al., 2012). These chemicals are added only to meet flame spread and smoke developed requirements; they do not prevent foam plastics from burning.

Thermal barriers prevent temperature rise and adequately protect foam plastic insulation from igniting during a fire. Fire statistics show very few fires, no fire deaths and very few injuries attributable to fire started or spread by insulation within structural areas (Ahrens, 2011).

The Commentary for the 2012 IRC for Section R316.5.1 Masonry or concrete construction states: "No thermal barrier is required when 1 inch (25 mm) or more of masonry or concrete is placed between the foam plastic and the interior of the building. The intent is to accept 1-inch (25 mm) of masonry or concrete as adequate protection against ignition, even though the concrete does not necessarily meet the performance criteria for thermal barriers."

This suggests that when foam plastic is separated from the interior of a building by minimum 1-inch (25mm) concrete or masonry, the flame spread and smoke developed requirements are not needed.

A precedent for a similar approach exists in Sweden where foam plastic insulation without flame retardants is used with code mandated protection by fire safe materials and construction (Blomqvist, McNamee, & Thureson, 2011; Lassen, Maag, Høibye, Vesterlykke, & Lundegaard, 2011; POPRC, 2011; Posner, Roos, & Olsson, 2010). Since the transition to non-flame retardant foam, there has been no detrimental impact on fire safety statistics in Sweden (Harrami & McIntyre, 2006; Lundqvist, McIntyre, & Hedman, 2008; Remberger et al., 2004).

In light of the available evidence, changing the code as proposed could:

-reduce and prevent harm from flame retardants without resulting in a reduction in fire safety,
-better align with the intent of the codes to establish "minimum requirements to safeguard the public safety, health and general welfare" and to provide "safety to fire fighters and emergency responders during emergency operations (R101.3)," and
-increase use of foam plastic insulations which are important for building energy efficiency by decreasing cost and by allowing flame-retardant free materials to be used in a code-compliant way for those concerned about flame retardant chemicals.

Substantiation: 1 inch (25 mm) or greater of concrete or masonry protects foam plastic from ignition in the same way as a thermal barrier which meets the criteria of NFPA 275- by preventing the energy of a fire from reaching the foam. Specifically, NFPA 275 states that after 15 minutes of a post-flashover fire, the temperature at the interface of the thermal barrier and foam cannot exceed 121°C average with 163°C at one peak value thermocouple. This is substantially below the auto-ignition temperature of plastic foams, which are in excess of 400°C for polystyrene and polyurethane (Babrauskas, 2003). As stated in the Commentary, concrete or masonry also has these characteristics.

Due to protection by thermal barriers, fire statistics show that insulation very rarely starts or spreads home fires. Insulation within a structural area was the item first ignited in 2% of US home structure fires, resulting in 10 civilian deaths and 90 civilian injuries (0% and 1% of the death and injury totals for the whole US, respectively). Insulation within a structural area was the primary item contributing to flame spread in 2% of US home structure fires, resulting in 0 civilian deaths and 40 injuries (0% and 1% of the death and injury totals for the whole US, respectively) (Ahrens, 2011).

HBCD and TCPP are added to foam plastics to meet flame spread and smoke developed requirements. 90% percent of HBCD and 86% of TCPP produced is used for building insulation (EC, 2008; Env Can, 2012; US EPA, 2010). Both chemicals are now widespread global contaminants (Covaci et al., 2006; Marvin et al., 2011; Van der Veen & de Boer, 2012). The presence of flame retardant chemicals can significantly increase the toxicity of fires when materials burn (Stec & Hull, 2011). Materials with flame retardants can produce greater amounts of carbon monoxide, smoke, and soot, compared to non-flame retardant materials (Babrauskas, 1992; Purser, 2000; Schnipper, Smith-Hansen, & Thomsen, 1995; Wichman, 2003). When HBCD burns, it produces dioxins, which are potentially carcinogenic (Birnbaum, Staskal, & Diliberto, 2003; Desmet, Schelfaut, & Sandra, 2005; Ebert & Bahadir, 2003). Firefighters have higher rates of cancers associated with dioxin exposure (IARC, 2010; LeMasters et al., 2006).

Canada and the European Union have scheduled HBCD to be phased out in the next 3-4 years (EC, 2011; Env Can, 2012). The US Environmental Protection Agency states that the chemical is

"…persistent in the environment, bioaccumulative in living organisms, and highly toxic to aquatic organisms."
and
"Human exposure is evidenced by the presence of HBCD in breast milk, adipose tissue, and blood, and it biomagnifies in the food chain. HBCD presents human health concerns based on animal test results indicating potential reproductive, developmental, and neurological effects. People may be exposed to HBCD from products and dust in the home and workplace, as well as its presence in the environment."
(US EPA, 2012)

Less is known about TCPP but concerns include its persistence in the environment, human exposure, and the potential to cause cancer (Van der Veen & De Boer, 2012).

Sweden uses the Eurocode classification system to rate the combustibility of building components including foam plastic insulation. Foam plastics are classified as combustible, and thus building codes specify how these materials can be used in fire safe ways, such as behind thermal barriers, concrete or masonry, and with other construction techniques (Blomqvist et al., 2011; Lassen et al., 2011; POPRC, 2011; Posner et al., 2010). Since non-flame retardant foam plastics have been used in Sweden, building fires and deaths from building fires have not increased, indicating that fire safety is maintained by the code mandated measures (Harrami & McIntyre, 2006; Lundqvist et al., 2008; Remberger et al., 2004).

From IRC Section 316.5.1 Commentary:

No thermal barrier is required when 1 inch (25 mm) or more of masonry or concrete is placed between the foam plastic and the interior of the building. The intent is to accept 1-inch (25 mm) of masonry or concrete as adequate protection against ignition, even though the concrete does not necessarily meet the performance criteria for thermal barriers. This condition can arise when foam plastics are installed either within a wall or on one side of a wall. Some common examples are when foam plastics are installed:

- In the cavity of a hollow masonry wall,
- As the core of a concrete-faced panel,
- On the exterior face of a masonry wall and covered with an exterior finish, or
- Within the cores of hollow masonry units.
- Encapsulated within a minimum of 1 inch (25 mm) concrete or masonry wall, floor or roof system, as in insulated tilt-up or pour-in-place

Also, the flame spread rating of the foam plastic used must comply with the requirements of Section R316.3, but the smoke-developed rating of the foam plastic is not limited.

From IRC Section R101.3 Intent:

> The purpose of this code is to establish minimum requirements to safeguard the public safety, health and general welfare through affordability, structural strength, means of egress facilities, stability, sanitation, light and ventilation, energy conservation and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

Bibliography:

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Babrauskas, V. (1992). Plastics, part B, The effect of FR agents on polymer performance. In V. Babrauskas & S. J. Grayson (Eds.), *Heat release in fires* (pp. 423–46). London: Elsevier Applied Science Publishers.
Babrauskas, V. (2003). *Ignition Handbook*. Issaqah, WA: Fire Science Publishers and Society of Fire Protection Engineers.
Babrauskas, V., Lucas, D., Eisenberg, D., Singla, V., Dedeo, M., & Blum, A. (2012). Flame retardants in building insulation: a case for re-evaluating building codes. *Building Research & Information*, *40*(6), 738–755. doi:10.1080/09613218.2012.744533
Birnbaum, L. S., Staskal, D. F., & Diliberto, J. J. (2003). Health effects of polybrominated dibenzo-p-dioxins (PBDDs) and dibenzofurans (PBDFs). *Environment international*, *29*(6), 855–60. doi:10.1016/S0160-4120(03)00106-5
Blomqvist, P., McNamee, M. S., & Thureson, P. (2011). Compilation of International Building Regulations (Fire) Relevant for EPS/XPS: SP Technical Note 2010:10, revised 2011-11-30. Borås, Sweden: SP Technical Insitute.
Covaci, A., Gerecke, A. C., Law, R. J., Voorspoels, S., Kohler, M., Heeb, N. V, Leslie, H., et al. (2006). Hexabromocyclododecanes (HBCDs) in the environment and humans: a review. *Environmental science & technology*, *40*(12), 3679–88.
Desmet, K., Schelfaut, M., & Sandra, P. (2005). Determination of bromophenols as dioxin precursors in combustion gases of fire retarded extruded polystyrene by sorptive sampling-capillary gas chromatography–mass spectrometry. *Journal of Chromatography A*, *1071*(1-2), 125–129. doi:10.1016/j.chroma.2004.12.019
Ebert, J., & Bahadir, M. (2003). Formation of PBDD/F from flame-retarded plastic materials under thermal stress. *Environment international*, *29*(6), 711–6. doi:10.1016/S0160-4120(03)00117-X
EC. (2008). European Union Risk Assessment Report: Tris (2-Chloro-1-methylethyl) phosphate TCPP. Luxembourg: European Commission, Ireland Chemicals Policy and Services.
EC. (2011). Commission Regulation (EU) No 143/2011 of 17 February 2011. *Official Journal of the European Union*, *L44*(54), 2–6.
Env Can. (2012). Proposed Risk Management Measure for Hexabromocyclododecane (HBCD). Gatineau. Quebec: Environment Canada, Health Canada, Chemicals Management Division.
Harrami, O., & McIntyre, C. (2006). Fire and fire protection in homes and public buildings: An analysis of Swedish fire statistics. Stockholm, Sweden: Swedish Chemicals Inspectorate (KEMI).
IARC. (2010). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: FIREFIGHTING. Lyon: International Agency for Research on Cancer.
Lassen, C., Maag, J., Høibye, L., Vesterlykke, M., & Lundegaard, T. (2011). Alternatives to the use of flame retarded EPS in buildings. Oslo, Norway: Norwegian Climate and Pollution Agency (KLIF) and COWI A/S.
LeMasters, G. K., Genaidy, A. M., Succop, P., Deddens, J., Sobeih, T., Barriera-Viruet, H., Dunning, K., et al. (2006). Cancer risk among firefighters: a review and meta-analysis of 32 studies. *Journal of occupational and environmental medicine / American College of Occupational and Environmental Medicine*, *48*(11), 1189–202.
Lundqvist, M., McIntyre, C., & Hedman, U. (2008). The Swedish Rescue Services in Figures. Karlstad, Sweden: Swedish Civil Contingencies Agency (MSB).
Marvin, C. H., Tomy, G. T., Armitage, J. M., Arnot, J. A., McCarty, L., Covaci, A., & Palace, V. (2011). Hexabromocyclododecane: current understanding of chemistry, environmental fate and toxicology and implications for global management. *Environmental science & technology*, *45*(20), 8613–23.
POPRC. (2011). UNEP/POPS/POPRC.7/19/Add.1 Addendum: Risk management evaluation on hexabromocyclododecane. Geneva, Switzerland: United Nations Environment Programme Persistent Organic Pollutants Review Committee.
Posner, S., Roos, S., & Olsson, E. (2010). Exploration of Management options for HBCD. Molndal, Sweden: Swerea IVF.
Purser, D. A. (2000). The performance of fire retardants in relation to toxicity, toxic hazard, and risk in fires. In A. Grand & C. Wilkie (Eds.), *Fire retardancy of polymeric materials.* (pp. 449–99). New York: Marcel Dekker, Inc.
Remberger, M., Sternbeck, J., Palm, A., Kaj, L., Strömberg, K., & Brorström-Lundén, E. (2004). The environmental occurrence of hexabromocyclododecane in Sweden. *Chemosphere*, *54*(1), 9–21. doi:10.1016/S0045-6535(03)00758-6
Schnipper, A., Smith-Hansen, L., & Thomsen, E. S. (1995). Reduced combustion efficiency of chlorinated compounds, resulting in higher yields of carbon monoxide. *Fire and Materials*, *19*(2), 61–64.
Stec, A. A., & Hull, T. R. (2011). Assessment of the fire toxicity of building insulation materials. *Energy and Buildings*, *43*(2-3), 498–506. doi:10.1016/j.enbuild.2010.10.015
US EPA. (2010). Hexabromocyclododecane (HBCD) action Plan. US Environmental Protection Agency.
US EPA. (2012). Partnership on Flame Retardant Alternatives for Hexabromocyclododecane (HBCD). Retrieved December 16, 2012, from http://www.epa.gov/dfe/pubs/projects/hbcd/index.htm
Van der Veen, I., & De Boer, J. (2012). Phosphorus flame retardants: Properties, production, environmental occurrence, toxicity and analysis. *Chemosphere*, *88*(10), 1119–53.
Wichman, I. S. (2003). Material flammability, combustion, toxicity and fire hazard in transportation. *Progress in Energy and Combustion Science*, *29*(3), 247–299.

Cost Impact: The code change proposal will not increase the cost of construction.

RB164-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.3 #2-RB-BABRAUSKAS

RB165 – 13
R316.3

Proponent: Michael D. Fischer, Kellen Company, representing the Center for the Polyurethanes Industry (mfischer@kellencompany.com)

Revise as follows:

R316.3 Surface burning characteristics. Unless otherwise allowed in Section R316.5 or R316.6, all foam plastic or foam plastic cores used as a component in manufactured assemblies used in building construction shall have a flame spread index of not more than 75 and shall have a smoke developed index of not more than 450 when tested in the maximum thickness <u>and density</u> intended for use in accordance with ASTM E 84 or UL 723. Loose-fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

> **Exception:** Foam plastic insulation more than 4 inches (102 mm) thick shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is *approved* in accordance with Section R316.6 using the thickness and density intended for use.

Reason: As applied to foam plastics, performance certifications (i.e. *approvals*) based on results for tests in accordance to ASTM E84 are limited to the maximum (nominal) thickness and density of the materials tested. Adding language with regard to density to R316.3 serves to more fully clarify and communicate the application of ASTM E84 test results to foam plastics.

Cost Impact: None.

RB165-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.3-RB-FISCHER

RB166 – 13
R316.4, R316.5.1, R316.5.2, R316.5.3, R316.5.7, R316.5.8

Proponent: Sean DeCrane, Battalion Chief, representing Cleveland Division of Fire, International Association of Fire Fighters (rovloc93@aol.com)

Revise as follows:

R316.4 Thermal barrier. Unless otherwise allowed in Section R316.5 or Section R316.6, foam plastic shall be separated from the interior of a building and the exterior of the building when installed within ten feet of a property line by an *approved* thermal barrier of minimum 1/2 inch (12.7 mm) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

R316.5 Specific requirements. The following requirements shall apply to these uses of foam plastic unless specifically *approved* in accordance with Section R316.6 or by other sections of the code or the requirements of Sections R316.2 through R316.4 have been met.

R316.5.1 Masonry or concrete construction. The thermal barrier specified in Section R316.4 is not required in a masonry or concrete wall, floor or roof when the foam plastic insulation is separated from the interior of the building and the exterior of the building where installed within ten feet of a property line by a minimum 1-inch (25 mm) thickness of masonry or concrete.

R316.5.2 Roofing. The thermal barrier specified in Section R316.4 is not required when the foam plastic in a roof assembly or under a roof covering is installed in accordance with the code and the manufacturer's installation instructions and is separated from the interior of the building by tongue-and-groove wood planks or wood structural panel sheathing in accordance with Section R803, not less than 15/32 inch (11.9 mm) thick bonded with exterior glue and identified as Exposure 1, with edges supported by blocking or tongue-and-groove joints or an equivalent material. The smoke-developed index for roof applications shall not be limited. A thermal barrier meeting the requirements of R316.4 is required where foam plastic in a roof assembly is installed within 10 feet of a property line.

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required in attics where all of the following apply:

1. *Attic* access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 11/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panels;
   3.3. 3/8-inch (9.5 mm) particleboard;
   3.4. 1/4-inch (6.4 mm) hardboard;
   3.5. 3/8-inch (9.5 mm) gypsum board; or
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm);
   3.7. 11/2-inch-thick (38 mm) cellulose insulation.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. Crawlspace access is required by Section R408.4

2. Entry is made only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 11/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panels
   3.3. 3/8-inch (9.5 mm) particleboard;
   3.4. 1/4-inch (6.4 mm) hardboard;
   3.5. 3/8-inch (9.5 mm) gypsum board; or
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm). The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

R316.5.5 Foam-filled exterior doors. Foam-filled exterior doors are exempt from the requirements of Sections R316.3 and R316.4.

R316.5.6 Foam-filled garage doors. Foam-filled garage doors in attached or detached garages are exempt from the requirements of Sections R316.3 and R316.4.

~~**R316.5.7 Foam backer board.** The thermal barrier specified in Section R316.4 is not required where siding backer board foam plastic insulation has a maximum thickness of 0.5 inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/m2) when tested in accordance with NFPA 259 provided that:~~

1. ~~The foam plastic insulation is separated from the interior of the building by not less than 2 inches (51mm) of mineral fiber insulation;~~
2. ~~The foam plastic insulation is installed over existing *exterior wall* finish in conjunction with re-siding; or~~
3. ~~The foam plastic insulation has been tested in accordance with Section R316.6.~~

~~**R316.5.8 Re-siding.** The thermal barrier specified in Section R316.4 is not required where the foam plastic insulation is installed over existing *exterior wall* finish in conjunction with re-siding provided the foam plastic has a maximum thickness of 0.5 inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/ m2) when tested in accordance with NFPA 259.~~

R316.5.9 Interior trim. The thermal barrier specified in Section R316.4 is not required for exposed foam plastic interior trim, provided all of the following are met:

1. The minimum density is 20 pounds per cubic foot (320 kg/m3).
2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is 8 inches (204 mm).
3. The interior trim shall not constitute more than 10 percent of the aggregate wall and ceiling area of any room or space.
4. The flame spread index does not exceed 75 when tested per ASTM E 84 or UL 723. The smoke-developed index is not limited.

R316.5.10 Interior finish. Foam plastics shall be permitted as interior finish where *approved* in accordance with Section R316.6 Foam plastics that are used as interior finish shall also meet the flame spread index and smoke developed index requirements of Sections R302.9.1 and R302.9.2.

R316.5.11 Sill plates and headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without the thermal barrier specified in Section R316.4 subject to all of the following:

1. The maximum thickness of the foam plastic shall be 31/4 inches (83 mm).

2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723.

R316.5.12 Sheathing. Foam plastic insulation used as sheathing shall comply with Section R316.3 and Section R316.4. Where the foam plastic sheathing is exposed to the *attic* space at a gable or kneewall, the provisions of Section R316.5.3 shall apply.

R316.5.13 Floors. The thermal barrier specified in Section R316.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation when the foam plastic is covered by a minimum nominal 1/2-inch-thick (12.7 mm) wood structural panel or equivalent. The thermal barrier specified in Section R316.4 is required on the underside of the structural floor system that contains foam plastic insulation when the underside of the structural floor system is exposed to the interior of the building.

R316.6 Specific approval. Foam plastic not meeting the requirements of Sections R316.3 through R316.5 shall be specifically *approved* on the basis of one of the following *approved* tests: NFPA 286 with the acceptance criteria of Section R302.9.4, FM4880, UL 1040, or UL 1715, or fire tests related to actual end-use configurations. Approval shall be based on the actual end use configuration and shall be performed on the finished foam plastic assembly in the maximum thickness intended for use. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

R316.7 Termite damage. The use of foam plastics in areas of “very heavy” termite infestation probability shall be in accordance with Section R318.4.

Reason: One of the main challenges the fire service is encountering in today’s environment is a pressing need of resources. Across the United States we are experiencing the loss of structures due to exterior exposures. These exposure fires can have devastating effects on an individual’s home and also place responding fire fighters at risk for rapidly spreading fires.

As the Fire Service encounters the economic realities of smaller budgets and increased demand we are continuously being asked to do more with less. Responding units many times must address growing exposure fires due to the narrow property lines.

In today’s environment there is a growing trend to promote energy conservation. While this is widely supported, and a worthy goal, we must also factor in a level of safety. As with most things in life there must be a balance between efficiency and safety.

A search of the Vinyl Siding Institute’s website www.vinylsiding.org produces a great deal of information on the R-Values and potential cost benefits of increasing the use of foam backing on the vinyl siding. There is little information on the fire performance of these products. It is true many of the foam insulation products are given a Class A flame spread rating in an ASTM E 84 Test Standard. That is one of the problems, the E 84 is a horizontal test standard yet we install the foam insulation products vertically drastically impacting the true fire performance in the field. In fact to demonstrate the safety of vinyl siding it is compared to the performance of vinyl sheathed wiring: *“Additionally, vinyl meets the stringent National Fire Protection Association (NFPA) requirements. The NFPA Electrical Code recognizes the strong fire-safe characteristics of vinyl through its approved use as a residential wiring insulator. Millions of homes have been wired using safe vinyl-sheathed electrical systems for decades.*[1]

They further state; *Safe homes use fire-safe claddings, which include vinyl siding. Why does vinyl siding provide good fire performance? It is composed mainly of polyvinyl chloride, more commonly known as vinyl or PVC. Due to its chlorine base, vinyl siding does not ignite quickly and is inherently flame-retardant. Read on to discover more facts on vinyl siding’s fire performance…..All organic materials (that is, anything containing carbon) will ignite. But the higher the temperature a material has to reach before it flames, the safer it is. PVC won’t ignite, even from another flame, until it reaches about 730°F (387°C) and won’t self-ignite until about 850°F (454°C).* [1] Fire doesn’t propagate until 750°F, what is the temperature of flame? Again, our issue isn’t necessarily the siding it is the foam backing behind it as the siding when exposed to high temperatures will begin to melt and fall away exposing the increasing amounts of foam insulation.

Current tests are being conducted by UL and NIST and additional testimony and data will be presented during the code development process.

1. 2005 National Electrical Code, NFPA 70, Article 334.

Cost Impact: Will not increase the cost of construction

RB166-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.4-RB-DECRANE

RB167 – 13
R316.4

Proponent: Dennis Pitts, American Wood Council, representing American Wood Council
(dpitts@awc.org)

Revise as follows:

R316.4 Thermal barrier. Unless otherwise allowed in Section R316.5 or Section R316.6, foam plastic shall be separated from the interior of a building by an *approved* thermal barrier of minimum 1/2 inch (12.7 mm) gypsum wallboard, <u>23/32 inch (18.2 mm) wood structural panel</u> or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

Reason: Wood structural panels are permitted prescriptively as a thermal barrier in various thicknesses in subsections of R316.5. R316.5.2 allows 15/32" WSP as a thermal barrier in roofs, R316.5.3 allows ¼" WSP for attics, and R316.5.4 allows ¼" WSP for crawlspaces. This proposal would prescriptively allow a thicker WSP to be used as a thermal barrier in other applications that might arise.

Prior to a recent change in NFPA 275 that essentially requires a Class A flame spread rating for materials used as thermal barriers, 23/32" WSP complied with NFPA 275. This proposal prescriptively recognizes a history of satisfactory service as a thermal barrier, even for thinner panels, although the material isn't a Class A material.

Cost Impact: No increase in cost of construction.

RB167-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.4-RB-PITTS

RB168 – 13
R316.5.3

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement*, James Hardie Building Products, and Self

Revise as follows:

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. *Attic* access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 1½-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panels;
   3.3. 3/8-inch (9.5 mm) particleboard;
   3.4. 1/4-inch (6.4 mm) hardboard;
   3.5. 3/8-inch (9.5 mm) gypsum board; ~~or~~
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm);
   3.7. 1½-inch-thick (38 mm) cellulose insulation<u>; or</u>
   <u>3.8. ¼-inch (6.4 mm) fiber-cement panel, soffit or backer board</u>.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

Reason: ¼-inch fiber-cement panel complying with ASTM C1186, Type A, or ASTM C1288, or ISO 8336, Category C, has a flame spread of 0 and smoke developed index of 5 or less. The proposed fiber-cement is also classed as noncombustible in accordance with ASTM E 136 (see attached ICC-ES ESR-1381[reference Section 3.0], ESR-1572[reference Section 3.0], ESR-1844[reference Section 3.1], ESR-2290[reference Section 3.1], and ESR-2894[reference Section 3.2]) documenting these claims. The fiber-cement panel has also been tested in accordance with NFPA 268 (see attached test reports) for compliance with the provisions of IBC Section 2603.5.7 "Exceptions" for "Ignition".

IBC Section 2603.5.7 has, as a result of the Group A IBC Code Hearings, been revised to add fiber-cement when tested in accordance with both ASTM E84 and NFPA 268. This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment.

Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1288, *Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets*. Fiber-cement producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement products for compliance with ISO 8336. The inclusion of this Standard reference in the IRC will permit manufacturers worldwide to demonstrate product compliance to IBC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade.

Cost Impact: The code change proposal will not increase the cost of construction because the proposed code change is editorial in nature to better clarify and present the backer board products currently recognized in the Code.

RB168-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.3-RB-MULDER

RB169 – 13
R316.5.3, R316.5.4

Proponent: Rick Thornberry, P.E., representing Cellulose Insulation Manufacturers Association (CIMA)

Revise as follows:

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. *Attic* access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 1 1/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panel~~s~~;
   3.3. 3/8-inch-thick (9.5 mm) particleboard;
   3.4. 1/4-inch-thick (6.4 mm) hardboard;
   3.5. 3/8-inch-thick (9.5 mm) gypsum wallboard; ~~or~~
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm);
   3.7. 1.5-inch thick (38 mm) cellulose insulation; or
   3.8. Other approved material installed in such a manner that the foam plastic insulation is not exposed.

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. Crawlspace access is required by Section R408.4
2. ~~Entry is made~~ The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 11/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panel~~s~~;
   3.3. 3/8-inch-thick (9.5 mm) particleboard;
   3.4. 1/4-inch-thick (6.4 mm) hardboard;
   3.5. 3/8-inch-thick (9.5 mm) gypsum wallboard; ~~or~~
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm); or
   3.7 Other approved material installed in such a manner that the foam plastic insulation is not exposed

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

Reason: The purpose of this code change proposal is to make Sections R316.5.3 and R316.5.4 in the IRC more consistent with Section 2603.1.4.6 in the IBC. This should help to avoid possible misapplications of these sections and make the code more user friendly.

Cost Impact: This code change proposal will not increase the cost of construction.

RB169-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.3-RB-THORNBERRY.doc

RB170– 13
R316.5.3

Proponent: John Woestman, Kellen Company, representing Extruded
(jwoestman@kellencompany.com)

Revise as follows:

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where <u>the foam plastic insulation has been tested in accordance with R316.6 or where</u> all of the following apply:

1. *Attic* access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 11/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panels;
   3.3. 3/8-inch (9.5 mm) particleboard;
   3.4. 1/4-inch (6.4 mm) hardboard;
   3.5. 3/8-inch (9.5 mm) gypsum board; or
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm);
   3.7. 11/2-inch-thick (38 mm) cellulose insulation.

~~The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.~~

Reason: This proposal is an attempt to clarify requirements of the IRC in Section R316.5.3. Section R316.6 specifically allows foam plastic insulation meeting one of the tests specified in R316.6 to not be required to meet the prescriptive requirements of Sections R316.3 through R316.5. This proposal makes it explicitly clear Items 1 and 2 (and Item 3) of R316.5.3 are not a requirement for foam plastic insulation that complies with R316.6.

Cost Impact: None

RB170-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.3-RB-WOESTMAN

RB171 – 13
R316.5.4

Proponent: John Woestman, Kellen Company, Representing Extruded Polystyrene Foam Association (XPSA) (jwoestman@kellencompany.com)

Revise as follows:

R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where the foam plastic insulation has been tested in accordance with Section R316.6 or where all of the following apply:

1. Crawlspace access is required by Section R408.4
2. Entry is made only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
   3.1. 11/2-inch-thick (38 mm) mineral fiber insulation;
   3.2. 1/4-inch-thick (6.4 mm) wood structural panels;
   3.3. 3/8-inch (9.5 mm) particleboard;
   3.4. 1/4-inch (6.4 mm) hardboard;
   3.5. 3/8-inch (9.5 mm) gypsum board; or
   3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

~~The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.~~

Reason: This proposal is an attempt to clarify requirements of the IRC in Section R316.5.4. Section R316.6 specifically allows foam plastic insulation meeting one of the tests specified in R316.6 to not be required to meet the prescriptive requirements of Sections R316.3 through R316.5. This proposal makes it explicitly clear Items 1 and 2 (and Item 3) of R316.5.4 are not a requirement for foam plastic insulation that complies with R316.6.

Cost Impact: None

RB171-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.4-RB-WOESTMAN

RB172 – 13
R316.5.11

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R316.5.11 Sill plates and headers. Foam plastic shall be permitted to be ~~spray~~ applied to ~~a~~ sill plates and headers or installed in the perimeter joist space without the thermal barrier specified in Section R316.4 subject to all of the following:

1. The maximum thickness of the foam plastic shall be 31/4 inches (83 mm).
2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m^3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723.

Reason: This proposal extends the same liberties to rigid foam that are currently enjoyed by spray foam products provided they meet the same criteria. Also, the language is tweaked to make clear that the application includes the rim joist area.

Cost Impact: None

RB172-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.11-RB-DAVIDSON

RB173 – 13
R316.5.11

Proponent: Michael D. Fischer, Kellen Company, representing the Center for the Polyurethanes Industry (mfischer@kellencompany.com)

Revise as follows:

R316.5.11 Sill plates and headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without the thermal barrier specified in Section R316.4 ~~subject to all of the following:~~ when

~~1. The maximum thickness of the foam plastic shall be 3-1/4 inches (83 mm).~~
~~2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m3).~~
~~3. T~~the foam plastic ~~shall have~~ has a flame spread index of 25 or less and a~~n accompanying~~ smoke-developed index of 450 or less, at the maximum thickness and density intended for use, when tested in accordance with ASTM E 84 or UL723.

Reason: The two, main applications for spray-applied foam plastic in sill plate and joist header areas are insulation and air sealing. Sill plates and joist headers (a.k.a. rim joists or band joists), by virtue of their location and function, exist in attics, crawl spaces, concealed spaces between floors and / or basements. In addition to location limitations, the relative volume available in these locations (into which the spray-applied foam plastic will be installed) is small and highly compartmentalized due to the floor / ceiling joists (see Commentary Figure R316.5.11). The intent of this section is to waive the prescriptive thermal barrier requirement for very limited amounts of foam plastic insulation in very specific and compartmentalized locations.

Although originally based on industry testing, the current limitations of 3-1/4 inches thickness and a density range of 0.5 to 2.0 lbs/cu-ft appear somewhat arbitrary and unnecessarily restrictive to products that provide flame spread index </= 25 and smoke developed index </= to 450; for example 4 inches thickness and 2.2 lbs/cu-ft or 6-inches thickness at 0.5 lbs/cu-ft.

The intent of this proposal *is not* to circumvent provisions for interior finishes or plastic trim.

Cost Impact: None.

RB173-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.5.11-RB-FISCHER

RB174 – 13
R316.6

Proponent: Tony Crimi, A.C. Consulting Solutions, Inc., representing North American Insulation Manufacturers Association (NAIMA) (tcrimi@sympatico.ca)

Revise as follows:

R316.6 Specific approval. Foam plastic not meeting the requirements of Sections R316.3 through R316.5 shall be specifically *approved* on the basis of one of the following *approved* tests: NFPA 286 with the acceptance criteria of Section R302.9.4, FM4880, UL 1040, or UL 1715, or fire tests related to actual end-use configurations. Approval shall be based on the actual end use configuration and shall be performed on the finished foam plastic assembly in the maximum thickness intended for use. <u>Foam plastics that are used as an interior finish on the basis of special tests shall also conform to the smoke-developed requirements of Section R302.9.4 or Section R316.3.</u> Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

Reason: At a minimum, the provision for special approvals for foamed plastics, which waives other requirements of the IRC for foamed plastics needs to provide a comparable level of performance and safety to the existing provisions. The exception for foamed plastics in R316.6 does not adequately cover smoke developed performance of foamed plastics. Current requirements for glass fiber, mineral fiber, cellulose and reflective plastic core insulation all require both flame spread and smoke development requirements either based on ASTM E84 or UL 723 or R302.10 Alternative methods are acceptable for use, however, their performance level needs to address the same hazards as the base requirement, plus any additional hazards that might arise as a result of a specific material. This proposal makes the section more consistent with the parallel provision in the IBC.

Justification: For all other thermal and sound insulating materials within the IRC, including non-combustible insulation materials, the minimum performance level for materials permitted to be used includes at least some requirements for both flame spread (fire growth) and smoke production. These requirements are primarily based on either ASTM E84 testing or alternative methods such as NFPA 286 and CAN/ULC-S102.2. However, in the case of foamed plastics, of the four alternative test methods permitted by 2603.9, only NFPA 286 contains any limits on smoke developed for any foamed plastics by virtue of the inclusion of a reference to section R302.9.4.

Room corner tests such as FM 4880, UL 1040, NFPA 286 or UL 1715 do evaluate fire growth and flashover. However, with the exception of the criteria for NFPA 286 in R302.9.4, the pass/fail criteria proposed for the room corner tests in the proposed acceptance criteria do not include quantitative evaluation of smoke density. Criteria for fire and smoke performance of building materials are based as much on issues arising from smoke production from burning materials, and smoke migration within the occupied spaces. It is not reasonable to provide an exception to the basic ASTM E84 flame spread and smoked developed requirements which apply to all other types of insulations, even non-combustible insulations, for foamed plastics based on room corner tests unless the limits on smoke production are applied to all of the room corner tests.

There are numerous reported instances of the hazards associated with smoke production from building materials. One is the tragic fire at the Greenwood Health Center in Hartford, CT on Feb 26 2003. The New York Times quoted Chief Charles A. Teale of the Hartford Fire Department as stating that “Most of the 10 residents killed, ranging in ages from 27 to 76, died of smoke inhalation”. The same article further goes on to quote officials as saying: “The nursing home itself suffered little damage, though, and the fire was put out in about 15 minutes. Most of the residents were then led back inside, and by midday, 84 of the 148 residents remained at the center”.

It is reasonable to allow alternative methods of testing materials to determine their acceptability for use, however, their performance criteria needs to address the same hazards as the base requirement, plus any additional hazards that might arise as a result of a specific material.

Cost Impact: This code change proposal will not increase the cost of construction.

RB174-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.6-RB-CRIMI.doc

RB175 – 13
R316.5.12, R316.8 (New), Chapter 44

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council – Plastics Division (Jcrandell@aresconsulting.biz)

Revise as follows:

R316.5.12 Sheathing. Foam plastic insulation used as sheathing shall comply with Section R316.3 and Section R316.4. Where the foam plastic sheathing is exposed to the *attic* space at a gable or knee wall, the provisions of Section R316.5.3 shall apply. <u>Where foam plastic insulation is used as exterior wall sheathing on framed wall assemblies, it shall comply with Section R316.8.</u>

<u>**R316.8 Wind Resistance.** Foam plastic insulation complying with ASTM C 578 and ASTM C 1289 and used as exterior wall sheathing on framed wall assemblies shall comply with SBCA FS 100 for wind pressure resistance unless installed directly over a sheathing material that is separately capable of resisting the wind load or otherwise exempted from the scope of SBCA FS 100.</u>

Add new standards to Chapter 44 as follows:

<u>**SBCA**</u>

Standard Reference	Title	Referenced in code section number
<u>FS 100-12</u>	<u>Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies</u> ……….	<u>R316.8</u>

Reason: This ANSI standard (FS 100-12) was approved for the 2015 IBC. It also is needed in the IRC to address the use of foam plastic insulating sheathing in exterior wall covering assemblies where resistance to wind pressure is required. This standard provides a methodology by which a manufacturer can qualify their product, through testing, to meet the requirements of the I-codes in establishing the wind pressure resistance of the product. It also provides for on-going quality control procedures to ensure that the product continues to meet its qualified wind pressure resistance. The ANSI standard supplements the applicable ASTM materials standards also referenced in the code change proposal. The current version of the standard is available at www.sbcindustry.com/fs100.php

Cost Impact: The code change proposal will increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, [SBCA FS 100-12] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB175-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R316.8 (NEW)-RB-CRANDELL

RB176 – 13
R317.3

Proponent: Randall Shackelford, P.E., representing Simpson Strong-Tie Co., Inc. (rshackelford@strongtie.com)

Revise Sections as follows:

R317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. <u>Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F 1667.</u>

Reason: The reason for this proposal is to specify the permissible types of stainless steel that driven fasteners used with treated wood can be manufactured from.

ASTM F 1667 reads as follows:

6. **Material Requirements**
   - 6.1 Steel wire used in the manufacture of driven fasteners shall be of low carbon, medium-low carbon, or medium-high carbon.
   - 6.2 Stainless steel wire used in the manufacture of driven fasteners shall be of Types 302, 304, 305, or 316.
     So the intent here is to require fasteners used with treated wood to be manufactured from Types 302, 304, 305, or 316 stainless steel.

There has been a lot of work done on fasteners and connectors in contact with treated wood in the last 8-10 years. All the testing and historical performance of stainless steel were based on the traditional use of 300 series stainless steel.
Yet there are many types of stainless steel, and some are much less corrosion resistant than others. By limiting the types of stainless steel to these specific series, it ensures that the stainless steel fasteners will be corrosion resistant when exposed to treated wood.

There is precedent for this. Section 402.1.1 specifies that for wood foundations stainless steel fasteners must be "of Type 304 or 316 stainless steel". Section R905.10.4 states "Copper, brass, bronze, copper alloy and 300-series stainless steel fasteners shall be used for copper roofs." Further, ASTM F 1667 is already specified for several different types of fasteners in the IRC.
The result of this proposal is not to require the exclusive use of 300-series stainless steel fasteners. This section permits hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze, or copper fasteners. The existing sentence before the added one is meant to specify a minimum coating weight for the galvanized fasteners so they perform as expected. The new proposed sentence does the same thing for stainless steel fasteners.

Cost Impact: The vast majority of driven stainless steel fasteners are manufactured from 300 series stainless steel. However, if a manufacturer were supplying the lesser-performing (and lower cost) stainless steel types and a builder had to use the standard 300 series stainless steel instead, there could be a cost increase. But the increase in performance would justify the additional cost. However, the use of the stainless steel fastener is not required anyway, as stated in the reason statement.

RB176-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R317.3-RB-SHACKELFORD

RB177 – 13

R320.1, R320.1.1 (New)

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee (cbaldassarra@rjagroup.com)

Revise as follows:

R320.1 Scope. Where there are four or more *dwelling* units ~~or *sleeping units*~~ in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply.

<u>**R320.1.1 Guest rooms**. A dwelling with guestrooms shall comply with the provisions of Chapter 11 of the *International Building Code* for Group R-3. For the purpose of applying the requirements of IBC chapter 11, *guestrooms* shall be considered sleeping units.</u>

<u>**Exception:** Lodging houses.</u>

Reason: Residential and institutional occupancies with 6 or more residents are within the scope of the IBC only and cannot be constructed under the IRC. This is based on both the scope of the IRC and IBC. Scoping provisions of the IRC and IBC, and code provisions within the IBC permit some residential and institutional occupancies with 5 or fewer occupants to be constructed in accordance with the IRC as an alternative to compliance with the IBC. The IBC occupancies that allow use of the IRC for five or fewer guests are: Group R-3 lodging houses (see G40-13), lodging houses are also in the scope of the IRC in section 101.2 #2; section 308.3.1 for Group I-1 and 308.4.1 for Group I-2.

Per the 2010 ADA Standard for Accessible Design and the IBC 1103.2.11 owner occupied lodging houses with 5 or fewer guests are not required to be accessible. So compliance with the IRC works for this condition without causing any conflicts with the IBC. If the lodging house is not owner occupied or accommodates more than 5 guests the building is outside of the scope of the IRC and accessibility is addressed since the building will be constructed per the IBC.

The issue addressed by this code change is how to handle 2012 IBC Sections 308.3.1 for I-1 and 308.4.1 for I-2. These sections classify the building as Group R-3 or allow use of the IRC for these institutional uses that have 5 or fewer care recipients. If it is classified as Group R-3 then IBC section 1107.6.3 provides requirements for accessibility of the building. Clearly the intent of Section 1107.6.3 is that if you have 4 or 5 care recipients the "sleeping units" must be Type B (subject to Section 1107.7 exceptions). The problem is that IRC structures by scope and definition do not have sleeping units:

> **R101.2 Scope.** The provisions of the *International Residential Code for One- and Two-family Dwellings* shall apply to the construction, *alteration,* movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and townhouses not more than three stories above *grade plane* in height with a separate means of egress and their *accessory structures.*
>
> **DWELLING.** Any building that contains one or two *dwelling units* used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

Adding the IBC definition of sleeping units to the IRC does not work because IBC sleeping units are not part of a dwelling unit. The current IBC definition of sleeping units states that "Such rooms and spaces that are also part of a dwelling unit are not sleeping units". Having a building constructed under the IRC that is not a dwelling unit, but a building with multiple sleeping units, is outside of the scope of the IRC.

Any of the Group I uses for 5 and under that are built to the IRC should have the same accessibility requirements as a Group R-3 constructed building. The IRC does not have sleeping units. Under the IRC such facilities are a dwelling unit with guest rooms. While the IRC contains a definition for guestroom, it is not clear on how the guestrooms should be counted for accessibility. Since the resident rooms are not sleeping units but guest rooms the current Section R320.1 does not require accessibility per Chapter 11 of the IBC for any IRC structures that have multiple guest rooms in one dwelling unit. The solution proposed here is to delete sleeping units from Section R320.1 to remove the confusion about the scope of sleeping units in the IRC and to add new Section R320.1.1 to address guestrooms. The statement that guestrooms shall be considered sleeping units for the purpose of applying IBC Chapter 11 is necessary because we cannot change the IBC language until the 2018 cycle. We plan to propose a more coordinated change for both the IBC and IRC to address this issue in the 2018 cycle. The exception for lodging houses is to maintain the exemption from accessibility requirements for lodging houses consistent with IBC Section 1103.2.11.

The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/CTC/Pages/default.aspx. Since its inception in April/2005, the CTC has held twenty five meetings - all open to the public.

Cost Impact: None

RB177-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R320.1-RB-BALDASSARRA

RB178 – 13
R320.1

Proponent: Steve Orlowski, representing National Association of Home Builders (NAHB) (sorlowski@nahb.org)

Add new text as follows:

R320.1 Scope. Where there are four or more *dwelling* units or sleeping units in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply.

> **Exception:** Owner-occupied lodging houses with five or fewer guestrooms or sleeping units constructed in accordance with the *International Residential Code* are not required to be accessible.

Reason: Based on the action taken during the Group A Hearings, Lodging houses are now referenced in the IBC. It was noted during the hearings, that lodging houses with five or fewer guest rooms or sleeping units are not required to be accessible under the 2010 ADA Guidelines. This proposal simply clarifies that lodging houses are not subject to the provisions of Chapter 11 of the IBC if they contain five or fewer guest rooms or sleeping units.

Cost Impact: The code change proposal will not increase the cost of construction.

RB178-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R320.1-RB-ORLOWSKI

RB179– 13

R320.2 (New)

Proponent: Dominic Marinelli, representing United Spinal Association (dmarinelli@accessibility-services.com)

Revise as follows:

R320.2 Type C units. Dwelling units and townhouses shall be provided with the accessible features for Type C units in accordance with the applicable portions of Chapter 10 of ICC A117.1. Type C units are permitted to be designed and constructed as accessible units, Type A units or Type B units.

> **Exception:** An exterior circulation path is not required where site constraints beyond the control of the owner prevent its installation.

Reason: As the Type C dwelling unit technical criteria are now included in the 2009 ANSI A117.1 Standard (Section 1005) we would like to insert A117.1 as a reference standard in the IRC to make it clear for jurisdictions that wish to adopt Section 1005 of ANSI A117.1 through legislative scoping amendments to the IRC, that A117.1 is indeed a reference standard applicable for the IRC. The scoping in R320.2 will trigger compliance with Type C unit criteria, while the exception permits a reduction in Type C criteria based on site impracticality or other restrictions outside the owner's control.

Type C units are representative of the term also known as "Visitability" . Visitability is a growing trend nationwide that refers to single-family or owner-occupied housing designed in such a way that it can be lived in or visited by people who have trouble with steps or who use wheelchairs or walkers. The visitability criteria are intended to ensure that in new construction, certain basic accessible features are included at the time of construction, including a unit entrance located on a circulation path complying with Type C criteria, an accessible circulation path that connects the entrance of the unit with one toilet or bathroom, one habitable space with an area 70 square feet minimum, and if a food preparation area is provided on the entrance level, the circulation path shall connect to the food preparation area. There are also features for the bathroom that include reinforcements for grab bars and clearances similar to those required by the Fair Housing Act at the toilet room or bathroom on the entrance level of the unit. Doors along the unit interior circulation path shall have a clear width of 31 ¾ inches – the same as required by FHA.

As stated on Concrete Change's website by Eleanor Smith, a leading advocate for visitability, "First, the spirit of Visitability is as important as the list of features. That spirit says it's not just unwise, but unacceptable that new homes continue to be built with gross barriers — given the how easy it is to build basic access in the great majority of new homes, and given the harsh effects major barriers have on so many people's lives. These easily-avoided barriers cause daily drudgery; unsafe living conditions; social isolation; and forced institutionalization. Visitability is a movement to change home construction practices so that virtually all new homes — not merely those custom-built for occupants who currently have disabilities — offer a few specific features making the home easier for mobility-impaired people to live in and visit. Several people have asked for a more detailed definition, noting that the list of required features has not been identical in all Visitability-type legislation, handouts and other materials."

The inclusion of the Type C criteria in the A117.1 standard was the culmination of a task group that worked to take the various visitabillity ordinances in place throughout the country and incorporate visitability criteria into A117.1, which designers and builders were familiar with, so that when Visitability was presented to them, they could look to a familiar "standard" to understand what "Visitability" means in terms of design and construction.

Cost Impact: Indicate whether or not this proposal will impact construction costs.

RB179-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R320.2-RB-MARINELLI

RB180 – 13
R322.1, R322.1.6, R322.1.8, R322.1.9, R322.2, R322.2.1, R322.3, R322.3.2, R322.3.3, R322.3.4, and R106.1.3

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov; Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones and Coastal A Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with the provisions contained in this section. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.1.6 Protection of mechanical and electrical systems. Electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall be located at or above the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones and Coastal A Zones). If replaced as part of a substantial improvement, electrical systems, equipment and components; heating, ventilation, air conditioning and plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

> **Exception:** Locating electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones and Coastal A Zones) provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided they conform to the provisions of the electrical part of this code for wet locations.

R322.1.8 Flood-resistant materials. Building materials used below the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones and Coastal A Zones) shall comply with the following:

1. All wood, including floor sheathing, shall be pressure-preservative-treated in accordance with AWPA U1 for the species, product, preservative and end use or be the decay–resistant heartwood of redwood, black locust or cedars. Preservatives shall be listed in Section 4 of AWPA U1.
2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA-TB-2.

R322.1.9 Manufactured homes. New or replacement manufactured homes shall be elevated in accordance with Section R322.2 (flood hazard areas including A Zones) or Section R322.3 in coastal high-hazard areas (V Zones and Coastal A Zones). The anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured homes to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.2 Flood hazard areas (including A Zones). All areas that have been determined to be prone to flooding but not subject to high-velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1.5 feet and 3 feet or otherwise designated by the jurisdiction shall be designated as Coastal A Zones and are subject to the requirements in Section R322.3. All buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.3.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas not designated as Coastal A Zones shall have the lowest floors elevated to or above the design flood elevation.
~~2. Buildings and structures in flood hazard areas designated as Coastal A Zones shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or to the design flood elevation, whichever is higher.~~
2.~~3~~ In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.
3.~~4~~ Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R322.2.2.

R322.3 Coastal high-hazard areas (including V Zones and Coastal A Zones, where designated). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave–induced erosion shall be designated as coastal high-hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1.5 feet and 3 feet or otherwise designated by the jurisdiction shall be designated as Coastal A Zones. All buildings and structures constructed in whole or in part in coastal high-hazard areas and in Coastal A Zones, where designated, shall be designed and constructed in accordance with Sections R322.3.1 through R322.3.6.

R322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is:
1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees from the direction of approach, or
1.2 Located at the base flood elevation plus one foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees from the direction of approach.
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings, and for support of parking slabs, pool decks, patios, and walkways.

Exception: Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.

R322.3.3 Foundations. All buildings and structures erected in coastal high-hazard areas and Coastal A Zones, shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.4. Piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section R322.3.6. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave–velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24. Slabs, pools, pool decks and walkways shall be located and constructed to be structurally independent of buildings and structures and their foundations to prevent transfer of flood loads to the buildings and structures during conditions of flooding, scour or erosion from wave-velocity flow conditions, unless the buildings and structures and their foundation are designed to resist the additional flood load.

> **Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided the foundations are designed to account for wave action, debris impact, erosion, and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.

R322.3.4 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (479 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared and sealed by a registered design professional that:
    - 4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.
    - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.
5. In Coastal A Zones walls shall be provided with flood openings that meet the criteria of Section 322.2.2.

Add new text as follows:

R106.1.3 Information for construction in flood hazard areas. For buildings and structures located in whole or in part in flood hazard areas as established by Table R301.2(1), construction documents shall include:

1. Delineation of flood hazard areas, floodway boundaries and flood zones and the design flood elevation, as appropriate;
2. The elevation of the proposed lowest floor, including basement; in areas of shallow flooding (AO zones), the height of the proposed lowest floor, including basement, above the highest adjacent finished grade; and

3. The elevation of the bottom of the lowest horizontal structural member in coastal high hazard areas (V Zone) <u>and in Coastal A Zones where such zones are delineated on flood hazard maps identified in Table R301.2(1) or otherwise designated by the jurisdiction</u>; and
4. If design flood elevations are not included on the community's Flood Insurance Rate Map (FIRM), the building official and the applicant shall obtain and reasonably utilize any design flood elevation and floodway data available from other sources.

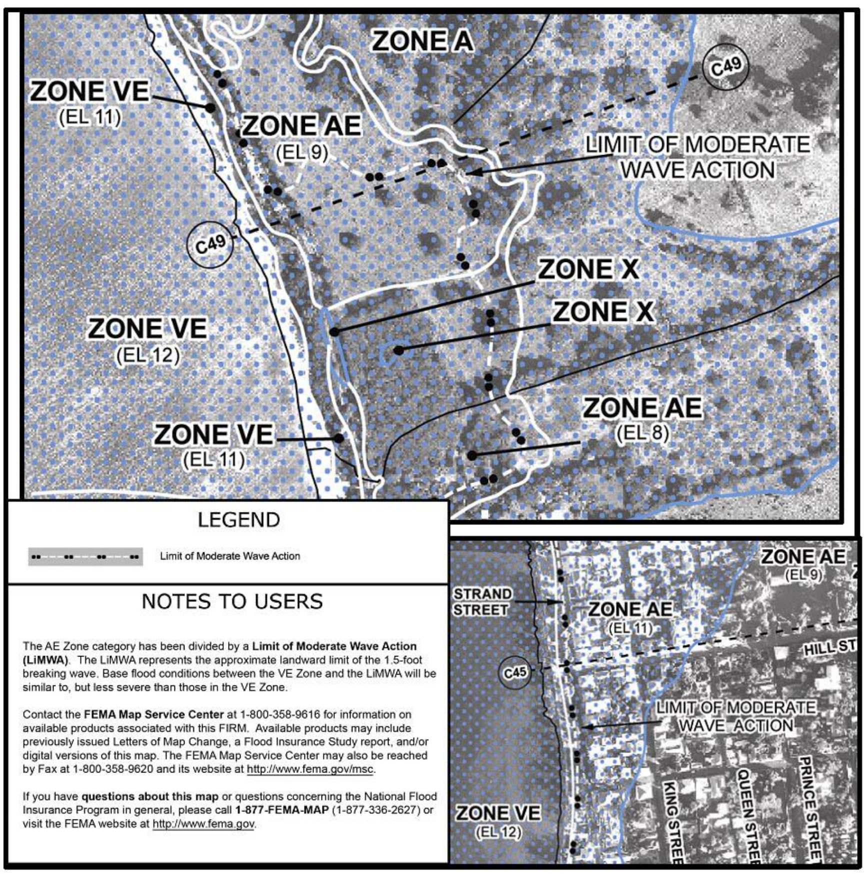
Reason: This proposal would require that dwellings in areas designated as "Coastal A Zones" meet the requirements of Section 322.3 for dwellings in coastal high hazard areas (Zone V), including open foundations (pilings or columns) with an exception that permits filled stemwalls.

The Coastal A Zone (CAZ) has been in ASCE 7 since the late '90s and in ASCE 24 since its initial publication in 1998. Recognition of CAZ was added to the 2009 edition of IRC Section R322.2, with the only requirement that if the area subject to waves between 1.5 ft and 3 ft is delineated, then the area is designated a Coastal A Zone and lowest floors shall be at least one-foot above the design flood elevation (i.e., in all other respects, the 2009 and 2012 IRC requires dwellings in Coastal A Zones to comply with the requirements for Zone A).

The inland boundary of the coastal high hazard area (Zone V) is drawn by FEMA where breaking wave heights are expected to drop below 3.0 ft during base flood conditions. The requirements for foundations of dwellings that are located just landward of the Zone V boundary are predicated on the assumption that hydrodynamic loads associated with waves – even waves that are 2.9-ft – are not significant and that conventional foundations such as perimeter walls can resist those loads and associated erosion and local scour.

FEMA's many post-disaster investigations after severe coastal storms have long recommended application of coastal high hazard area (Zone V) requirements to areas inland of the Zone V/Zone A boundary – in the area subject to waves between 1.5 ft and 3 ft – the area now referred to as "Coastal A Zone". Starting in fiscal year 2009, all coastal flood studies by FEMA will include analyses of moderate wave action and FIRMs will show the Limit of Moderate Wave Action (LiMWA).

The total land area that is likely to be designated as CAZ is small. FEMA has estimated that less than 3 percent of all mapped flood hazard areas are Zone V and the LiMWA generally is determined to be a relatively short distance inland from the Zone V boundary. The graphic below is from the December 2008 Procedure Memorandum No. 50 which established FEMA's policy to delineate the LiMWA on FIRMs



Every FEMA publication on coastal construction since mid-2000 has recommended the use of Zone V construction requirements in Coastal A Zones. As early as 1979 some communities were augmenting the minimum NFIP requirements because of observed wave damage to conventional, closed foundations (Santa Rosa Island Authority, Florida, 1979). FEMA's first Coastal Construction Manual, published in 1981, recognized that "high velocity water may be experienced due to the forward momentum of breaking waves, especially in the vicinity of the V zone/A zone interface." The defined term "Coastal A Zone" is used in the 1986 revision of the Coastal Construction Manual, and numerous papers and investigations have followed. Research performed in 1992 for the U.S. Army Corps of Engineers demonstrated that buildings on typical Zone A foundations (masonry walls, masonry piers, shallow piles, and slabs) "would be subject to failure for shallow erosion and /or wave heights less than 2-3 feet."

Observations after Superstorm Sandy continue to reinforce the damage potential in areas just inland of the Zone V boundary. FEMA's report based on field investigations will be completed mid-2013. Given that open foundations (piles and columns) perform well under velocity and wave conditions, FEMA believes it is time for the IRC to acknowledge that dwellings in Coastal A Zones should meet the same requirements as dwellings in coastal high hazard areas – with the exception of filled stemwalls that account for the potential for scour and erosion. Surveys and press reports after major coastal events such as Superstorm Sandy regularly report that citizens support stricter requirements (see www.reuters.com/article/2012/11/27/us-storm-sandy-newjersey-idUSBRE8AQ0V620121127, http://blog.nj.com/njv_editorial_page/2012/11/editorial_rebuild_carefully.html).

Cost Impact: This proposal will increase the cost of construction in areas shown on Flood Insurance Rate Maps as seaward of the Limit of Moderate Wave Action (or if a community elects to designate areas as "Coastal A Zones"). However, the risk of wave-induced damage or damage due to erosion and local scour is significantly reduced.

RB180-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1-RB-QUINN-WILSON

RB181 – 13
R322.1.4.2

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.1.4.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall demonstrate <u>with hydrologic and hydraulic analyses</u> that the effect of the proposed buildings and structures on design flood elevations, including fill, when combined with all other existing and anticipated flood hazard area encroachments, will not increase the design flood elevation more than one foot (305 mm) at any point within the jurisdiction.

Reason: The existing language simply requires applicants to demonstrate the effect of proposed buildings and structures on DFEs, without saying how it should be accomplished. This places an undue burden on the building official. The added phrase clarifies that analyses are required, specifically hydrologic and hydraulic analyses that are common terms in civil and water resources engineering. FEMA uses those terms to broadly refer to the study methods used to delineate flood hazard areas and to model the floodway.

Cost Impact: None

RB181-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.4.2-RB-QUINN-WILSON

RB182 – 13
R322.1.5

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.1.5 Lowest floor. The lowest floor shall be the <u>lowest</u> floor of the lowest enclosed area, including basement, but excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

Reason: The addition makes this provision match the definition in the NFIP regulations at 44 CFR 59.1 which is shown below (bold emphasis added to show where in the federal definition the word appears):

> "Lowest Floor means the **lowest** floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of Sec. 60.3."

Cost Impact: None

RB182-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.5-RB-QUINN-WILSON

RB183 – 13
R322.1.8

Proponent: Dennis Pitts, American Wood Council, representing American Wood Council (dpitts@awc.org)

Revise as follows:

R322.1.8 Flood damage-resistant materials. Building materials and installation methods used below the elevation required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones) shall be flood damage-resistant materials that conform to the provisions of FEMA TB-2. ~~comply with the following:~~

1. ~~All wood, including floor sheathing, shall be pressure-preservative-treated in accordance with AWPA U1 for the species, product, preservative and end use or be the decay–resistant heartwood of redwood, black locust or cedars. Preservatives shall be listed in Section 4 of AWPA U1.~~
2. ~~Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA-TB-2.~~

Reason: This proposal reflects changes approved to the IBC in FS150-12. Adoption of this change will make the IBC and IRC consistent. The specific requirement for preservative-treated wood or naturally decay-resistant wood below the elevation required in Section R322.2 is deleted because wood products such as plywood sheathing, plywood panel siding, and stud walls have been shown to be resistant to the effects of flood exposure without the aid of preservatives or the use of naturally durable wood.

Primary considerations for material performance and use in flood hazard areas are outlined in FEMA *TB2, Flood Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*, which is already referenced in the IRC. A flood damage resistant material is one that is "… capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage." Evaluation consists of consideration of material performance following 72 hour immersion and presence of only limited damage requiring no more than cosmetic repair (i.e. cleaning, sanitizing and resurfacing such as sanding, repair of joints, repainting). Research conducted by Oak Ridge National Laboratory and Tuskegee University (ORNL/TM-2005/34 *Field Testing of Energy-Efficient Flood-Damage-Resistant Residential Envelope Systems Summary Report,* June 2004) and field observations of material performance from actual floods were considerations in the update of FEMA TB2-2008. Within TB2 examples of wood that are not required to be preservative treated for flood damage resistance that may form a part of exterior walls and floors include studs and Exterior and Marine plywood used as wall sheathing. While preservative treated studs and preservative treated exterior plywood sheathing were not tested in the ORNL/Tuskegee study, it is not expected that presence of preservative treatment would improve the already acceptable performance of these materials.

General requirements for preservative treated or naturally durable wood for protection from decay and termites are addressed elsewhere in the IRC, and those applications will continue to be in effect, including in flood hazard areas.

Cost Impact: No increase in the cost of construction.

RB183-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.8-RB-PITTS

RB184 – 13
R322.1.8, R322.2.2, R322.3.2, R322.3.4, and R322.3.5

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.1.8 Flood-resistant materials. Building materials used below the elevation <u>of the lowest floor</u> ~~required in Section R322.2 (flood hazard areas including A Zones) or R322.3 (coastal high-hazard areas including V Zones)~~ shall comply with the following:

1. All wood, including floor sheathing, shall be pressure-preservative-treated in accordance with AWPA U1 for the species, product, preservative and end use or be the decay–resistant heartwood of redwood, black locust or cedars. Preservatives shall be listed in Section 4 of AWPA U1.
2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA-TB-2.

R322.2.2 Enclosed area below <u>lowest floor</u> ~~design flood elevation~~. Enclosed areas, including crawl spaces, that are below the <u>lowest floor</u> ~~design flood elevation~~ shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria:
   - 2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one en-closed area below the design flood elevation, each area shall have openings on exterior walls.
   - 2.2. The total net area of all openings shall be at least 1 square inch (645 mm2) for each square foot (0.093 m2) of enclosed area, or the openings shall be designed and the construction documents shall include a statement by a registered design profes-sional that the design of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in Section 2.6.2.2 of ASCE 24.
   - 2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground level.
   - 2.4. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.
   - 2.5. Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.
   - 2.6. Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.

R322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high-hazard areas shall be elevated so that the owest portion of all structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is:
   - 1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees (0.35 rad) from the direction of approach, or
   - 1.2 Located at the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees (0.35

rad) from the direction of approach.
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.

Exception: Walls and partitions enclosing areas below the lowest floor ~~design flood elevation~~ shall meet the requirements of Sections R322.3.4 and R322.3.5.

R322.3.4 Walls below lowest floor ~~design flood elevation~~. Walls and partitions are permitted below the lowest ~~elevated~~ floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the ele-vated portion of the building or supporting foundation system. Such walls, framing and connections shall have a de-sign safe loading resistance of not less than 10 (479 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared and sealed by a registered design professional that:
   4.1. The walls and partitions below the lowest floor ~~design flood elevation~~ have been designed to collapse from a water load less than that which would occur during the design flood.
   4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructur-al). Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.

R322.3.5 Enclosed areas below lowest floor ~~design flood elevation~~. Enclosed areas below the lowest floor ~~design flood elevation~~ shall be used solely for parking of vehicles, building access or storage.

Reason: The lowest floor, as defined in R322.1.5, may be required to be above the design flood elevation (e.g., if a Coastal A Zone is designated or in a coastal high hazard area depending on orientation of the lowest horizontal structural member). Also, owners and builders may elect to elevate the lowest floor higher than the minimum required elevation. Whether lowest floors are higher by choice or by the code, the walls that enclose areas below the lowest floors should meet the requirements. Floodwaters can and do rise higher than the elevations specified on flood maps, which show the elevation of the base flood (the 1 percent-annual chance (100-year) flood).

FEMA has observed enclosures where breakaway walls have a horizontal failure joint precisely at the base flood elevation, and enclosures where flood damage-resistant materials are used only below the base flood elevation. When floodwaters rise even a slightly higher, damage results. This does not meet the overall intent nor the letter of the NFIP regulations.

Cost Impact: There is no cost increase for the majority of dwellings; there may be a small increase for those where walls would be built to have different characteristics above and below the design flood elevation (e.g., a failure joint or different materials above and below the required elevation).

RB184-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.8 #1-RB-QUINN-WILSON

RB185 – 13
R322.1.9

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.1.9 Manufactured homes. New or replacement *manufactured homes* shall be elevated in accordance with Section R322.2 (flood hazard areas including A Zones) or Section R322.3 in coastal high-hazard areas (V Zones). The anchor and tie-down requirements of the applicable state or federal requirements ~~Sections AE604 and AE605 of Appendix E~~ shall apply. The foundation and anchorage of *manufactured homes* to be located in identified floodways shall be designed and constructed in accordance with ASCE 24.

Reason: Many states and local jurisdictions do not adopt IRC Appendix E. Rather than point to an appendix that is rarely adopted, this proposal replaces the requirement for anchor and tie-downs with a general reference to state or federal requirements. This permits compliance with state manufactured home installation standards or HUD's installation standards, whichever is required. HUD's regulations at CFR § 3285.302 specifies that "foundations, anchoring, and support systems must be capable of resisting loads associated with design flood and wind events or combined wind and flood events, and homes must be installed on foundation supports that are designed and anchored to prevent floatation, collapse, or lateral movement of the structure."

Cost Impact: None; no change in requirements for anchoring and tie-down, just change to citation to the requirements.

RB185-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.9 #1-RB-QUINN-WILSON

RB186 – 13
R322.1.9

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

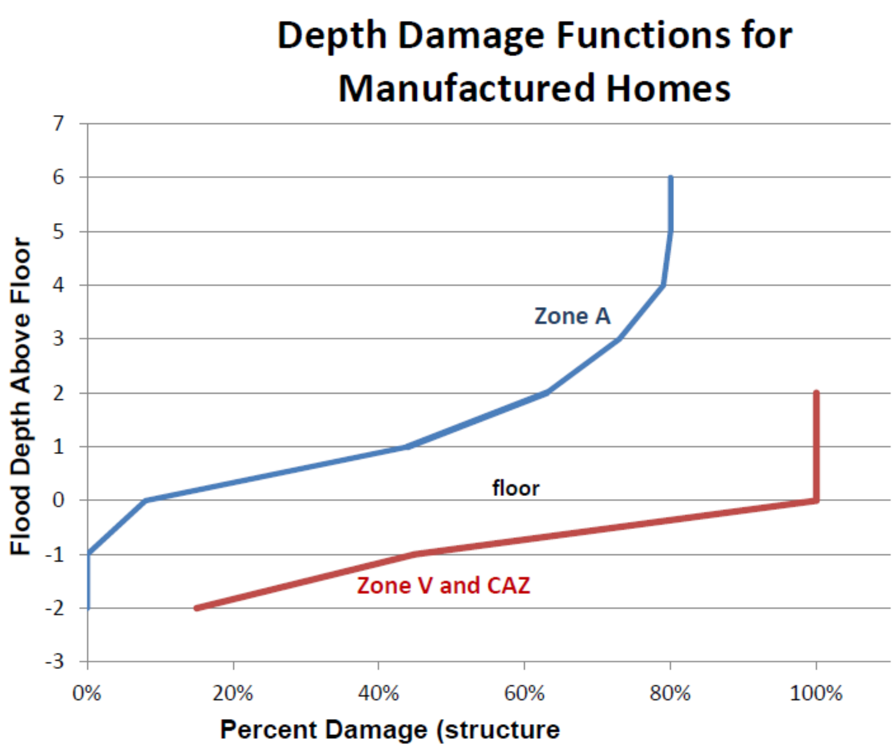
R322.1.9 Manufactured homes. <u>The bottom of the frame of new and</u> ~~New or~~ replacement manufactured homes <u>on foundations that conform to the requirements of Section R322.2 or Section R322.3, as applicable,</u> shall be elevated <u>to or above the elevations specified</u> in ~~accordance with~~ Section R322.2 (flood hazard areas including A Zones) or Section R322.3 in coastal high-hazard areas (V Zones). The anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured homes to be located in identified floodways shall be designed and constructed in accordance with ASCE 24

Reason: This proposal is based on the fact that manufactured homes are the most vulnerable type of structures in terms of risk of flood damage. The figures below illustrate how damage increases dramatically for just one foot of water above the lowest floor (walking surface). Requiring the bottom of the frame to be the reference point means the homes will be approximately one foot above the base flood elevation. Not only will the homes be less vulnerable to damage, owners will have lower flood insurance premiums.

The figure below is based on the data found in Table B-10 (Coastal A Zones and V Zones) and Table B-17 (all other SFHAs) *FEMA Benefit-Cost Analysis Re-engineering (BCAR), Flood Module Revision: Updates to Residential Depth Damage Functions (DDFs) and Guidance for Coastal Flooding* (January 2011; version 4.5.5). The riverine depth damage function curves for manufactured homes were originally developed by the NFIP many years ago and been used in FEMA's Benefit-Cost Analysis (BCA) software for years. FEMA convened an expert panel in 2010 to develop updated DDFs coastal high hazard areas and Coastal A Zones for various residential structures including manufactured homes.

The depth-damage functions show that a manufactured home in a Zone A will sustain more about 8% structure damage if floodwaters rise just to the elevation of the lowest floor (the walking surface), and more than 40% if water rises one foot higher. By requiring elevation based on the bottom of the frame, virtually no damage would be expected during base flood conditions.

If located in a Zone V or Coastal A Zone, the curve shows that a manufactured home will sustain nearly 100% damage if floodwaters rise to the elevation of the lowest floor. IRC R322.3.2 already references the bottom of the lowest horizontal structural member, which is the bottom of the frame.



Cost Impact: The cost of a foundation in Zone A will be marginally higher because of the approximately one additional foot that will have to be added to the foundation. The requirement to conform to the foundation requirements based on flood zone has always been implicit in the NFIP requirement that manufactured homes be "elevated on a permanent foundation . . . and be securely anchored to an adequately anchored foundation system to resist floatation collapse and lateral movement" (see 44 CFR 60.3(c)(6)).

RB186-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.9 #2-RB-QUINN-WILSON

RB187 – 13
R322.1.9 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows

R322.1.9 Stairways and ramps. Stairways and ramps that are located below the lowest floor elevations specified in Sections R322.2.1 or R322.3.2, as applicable to the flood hazard area, shall either:

1. Be designed and constructed to resist flood-related loads and to minimize transfer of flood-related loads to the building or structure; or
2. Break away during design flood conditions without causing damage to the building or structure; or
3. Be retractable, or be able to be raised, to or above the lowest floor elevations, provided the ability to be retracted or raised prior to onset of conditions of flooding is not contrary to means of egress requirements of the code.

(Renumber subsequent sections)

Reason: This proposal lays out options for satisfying the general requirement in R322.1.3 which requires “All buildings and structures erected in flood hazard areas shall be constructed by methods and practices that minimize flood damage.” That means stairways and ramps should resist flood loads along with the dwellings they serve. These same requirements are included in ASCE 24-13.

In coastal high hazard areas (Zone V), stairs that are not properly constructed to meet the free-of-obstructions requirement below elevated buildings can damage the building when they fail. This damage has been observed during FEMA’s post-flood investigations after numerous flood events (also see Figure 1 from NFIP Technical Bulletin 2 Free-of-Obstruction Requirements).

Figure 1. Stairs did not break away cleanly, resulting in damage to the elevated building.

Cost Impact: There should be no additional costs because of the existing requirement in R322.1.3.

RB187-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.1.9-(NEW)-RB-QUINN-WILSON

RB188 – 13
R322.2.1, R322.3.2

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (gregory.p.wilson@dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas ~~not~~ designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
~~2. Buildings and structures in flood hazard areas designated as Coastal A Zones shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or to the design flood elevation, whichever is higher.~~
2.~~3~~ In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or at least 3 feet (15 mm) ~~2 feet (610 mm)~~ if a depth number is not specified.
3.~~4~~ Basement floors that are below grade on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

   Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R322.2.2.

R322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high-hazard areas shall be elevated so that the bottom of the lowest ~~portion of all~~ horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
   ~~1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees (0.35 rad) from the direction of approach, or~~
   ~~1.2 Located at the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees (0.35 rad) from the direction of approach.~~
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.

   Exception: Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.

Reason: The purpose of this code change is to reduce flood risks on homes by adding a factor of safety of one-foot of additional height (called freeboard) to the elevation requirements. This proposal will align the IRC with the elevation requirements for Category II buildings (includes Group R), by reference to ASCE 24 which requires elevation to BFE + 1 or DFE, whichever is higher.

This statement identifies several reasons to add just one foot to the elevation requirements to the IRC.

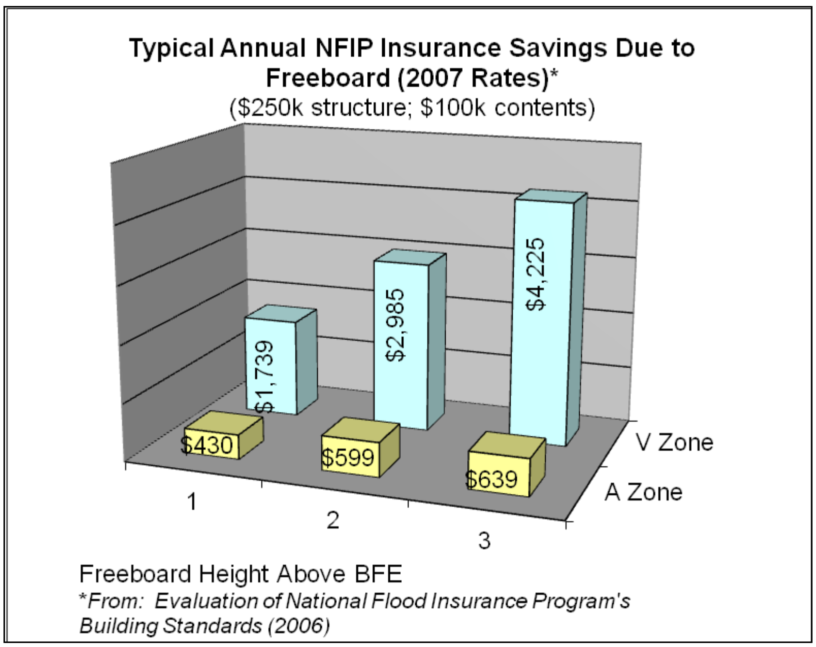
More than 20 states adopt the I-Codes at the state level and mandate local enforcement. Many of those states do not permit communities to modify the code. Some states do not explicitly recognize that communities may have a “stand alone” floodplain management ordinance that includes requirements for buildings, including elevation, and some provide that only the building code governs buildings (which may have the effect of nullifying building requirements in local ordinances). It is no longer valid to argue that the IRC should not provide reasonable protection of just one additional foot of elevation for dwellings based on the assumption that communities can separately adopt higher standards.

In New Jersey and New York, about 43 percent of the areas flooded by Superstorm Sandy had water that rose above the BFE (according to preliminary analyses). Of the land area where flooding exceeded BFE, about half was between BFE and BFE +1, and about a quarter was between BFE + 1 and BFE + 2. Although there isn’t a count of the total number of flooded homes in those areas, it’s easy to see that if lowest floors had been elevated just one foot higher, the majority would have had considerably less damage. According to a Quinnipiac University Polling poll taken shortly after Superstorm Sandy and cited by Reuters, “Seven in 10 New Jersey voters favored rebuilding the Jersey Shore under stricter building codes, including three-quarters of shore residents.”

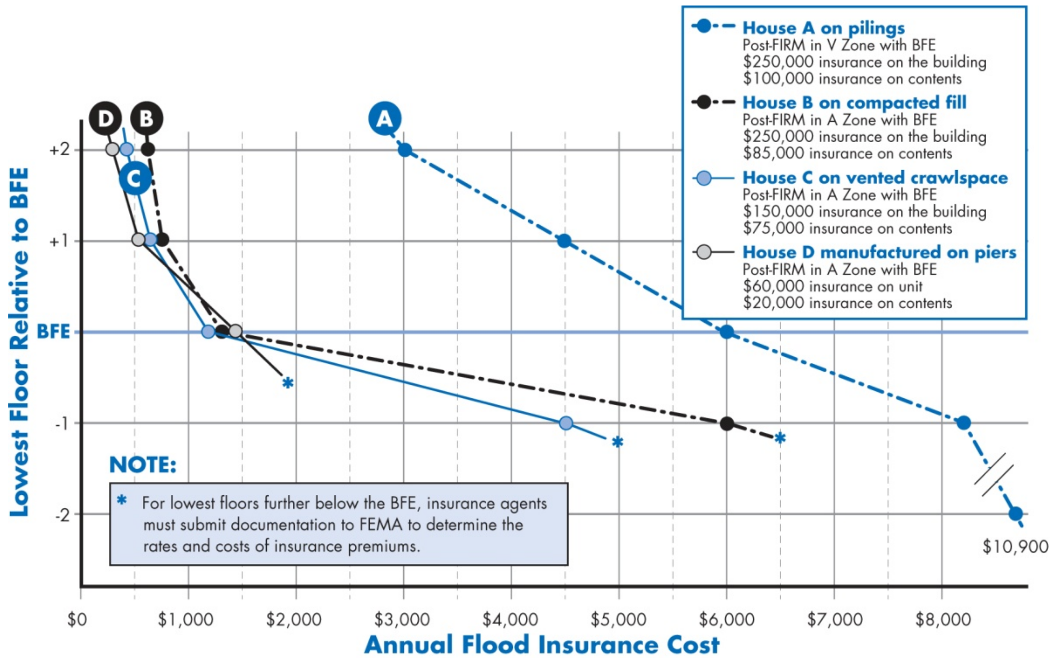
An independent report prepared for FEMA, *Evaluation of the National Flood Insurance Program's Building Standards* (October 2006), provides clear evidence of the benefits associated with adding freeboard. It documents the added costs (as a percent of the cost of building to the base flood elevation) and the benefits of adding freeboard. Approximately 1,500 combinations of house size, foundation type, flood zone, flood elevation, freeboard added, and discount rate were evaluated. The benefits considered are two-fold: flood damages avoided and flood insurance premium savings.

The report concluded that – based on flood damages avoided only -- it is worth spending an additional percentage of the at-BFE building cost to incorporate freeboard, where the percentage generally ranges from less than 1% to 5% for one-foot of freeboard, depending on the flood hazard zone. The cost of adding one-foot of freeboard, on the other hand, ranged from 0.25% to 3% of the at-BFE building cost (see cost statement below) depending on the type of foundation and the flood hazard zone. The flood damage reduction benefits of BFE + 1 ft outweighed the costs of constructing that freeboard in all but a few cases (e.g., where large quantities of fill are already needed to raise a Zone A building to the BFE).

The savings in insurance premium reduction (see graphic), which are realized by every homeowner for the life of the building, are on top of savings associated with avoiding future damage. Flood insurance premium savings alone can recover the added cost of freeboard in just a few years. Importantly, the report acknowledges that the computed benefits "are conservative, and will understate the true benefits" because some avoided costs are not accounted for, including clean-up and demolition costs, debris disposal costs, uninsured losses, displacement and relocation costs, loss of jobs and tax base, etc.



Additional substantiation for the additional elevation requirement is found in the insurance rating structure of the NFIP which bases rates for new buildings as a function of risk. Freeboard reduces risk because the lowest floors of buildings are elevated above the predicted flood levels associated with the base (100-year) flood. This risk reduction is reflected in reduced insurance rates, with reductions of 20% or more for the first foot of freeboard above the base flood elevation. The graphic below shows examples of how the cost of insurance varies as a function of elevation (based on insurance rates in effect in 2009). Note: the graphic illustrates insurance costs for four scenario dwellings with different foundation types and different values of the structure and contents; it should not be used for any purpose other than to illustrate the general variation in costs as a function of elevation. In Zone V, the annual cost of flood insurance is approximately 25% less if a number is one foot higher than the minimum (House A). In Zone A, the annual cost is approximately 40% less.



Further substantiation for this code change is found in Mitigation Assessment Team reports prepared by teams of experts assembled by FEMA after significant disasters. Reports prepared after hurricanes and flood disasters include recommendations to reduce future damage, including adding at least one-foot of freeboard (see bibliography). Specific recommendations are to adopt freeboard requirements that are consistent with those specified in ASCE 24.

Bibliography:

Mitigation Assessment Team reports published by FEMA, including: FEMA 490 Summary Report on Building Performance: 2004 Hurricane Season 2005); FEMA 549 Mitigation Assessment Team Report: Hurricane Katrina in the Gulf Coast (2006); FEMA P-757 Hurricane Ike in Texas and Louisiana (2009); FEMA P-765 Midwest Floods of 2008 in Iowa and Wisconsin (2009). Available online: http://www.fema.gov/fema-mitigation-assessment-team-reports

American Institutes for Research (October 2006), *Evaluation of the National Flood Insurance Program's Building Standards.* Available online: www.fema.gov/business/nfip/nfipeval.shtm.

Reuters. http://www.reuters.com/article/2012/11/27/us-storm-sandy-newjersey-idUSBRE8AQ0V620121127

Cost Impact: This code change will increase the initial cost of construction. The anticipated damage avoided because of the higher level of protection, other savings realized by owners, and the lower annual cost of federal flood insurance justify the added initial construction costs. Flood insurance premium savings alone can recover the added cost of freeboard in just a few years. As cited in the *Evaluation of the National Flood Insurance Program's Building Standards* (2006), the added cost is a function of the type of foundation. However, estimates of the cost increase over the cost to build a foundation at the base flood elevation range from less than 1% to 3% of to add one foot of freeboard, where the lower range is applicable to pile or masonry pier foundations and the upper end of the range applies to masonry walls with interior piers (crawlspace). The cost increase to add freeboard when placing fill to raise a slab-on-grade foundation is somewhat higher because the fill quantity and therefore costs do not increase linearly with added height. There is no requirement to use fill; lower-cost foundation types can be used.

RB188-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.1-RB-QUINN-WILSON

RB189 – 13
R322.2.2, R322.2.2.1 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria <u>and are installed in accordance with Section R322.2.2.1</u>:
   ~~2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.~~
   <u>2.1.</u> ~~2.2~~ The total net area of all openings shall be at least 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area <u>where the enclosed area is measured on the exterior of the enclosure walls</u>, or the openings shall be designed <u>as engineered openings</u> and the construction documents shall include a statement by a registered design professional that the design of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in Section 2.6.2.2 of ASCE 24.
   ~~2.3. The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground level.~~
   <u>2.2</u> ~~2.4~~ Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the all.
   ~~2.5. Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.~~
   <u>2.3 The presence of louvers, blades, screens and faceplates or other covers and devices shall not block or impede the automatic flow of floodwaters into and out of the enclosed areas and shall be accounted for in the determination of the net open area.</u>
   ~~2.6. Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.~~

<u>**R322.2.2.1 Installation of openings.** The walls of enclosed areas shall have openings installed such that:</u>

1. <u>There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.</u>
2. <u>The bottom of each opening shall be not more than 1 ft (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.</u>
3. <u>Openings shall be permitted to be installed in doors and windows; doors and windows without installed openings do not meet the requirements of this section.</u>

Reason: The primary purpose of this proposal is to reorganize to put all of the installation requirements in a separate section, separating installation from the requirements that apply to the openings themselves. There are only two minor clarifications in R322.2.2 about the openings themselves: (1) the square foot area of enclosures is to be measured from the outside; and (2) the net open area calculation has to take into account if there are louvers, blades, screens and faceplates because their presence affects the flow of water.

There is only one clarification in the proposed R322.2.2.1 for installation, and that is to specify that how high openings are installed in walls depends on the higher of the exterior finished grade or the interior grade (crawlspace) or floor (e.g., garage or stairwell). These changes are consistent with FEMA's NFIP Technical Bulletin 1, Openings in Foundation Walls and Walls of Enclosures http://www.fema.gov/plan/prevent/floodplain/techbul.shtm and similar to the provisions of the revised ASCE 24-13 that is a referenced standard in the IBC and IRC.

Cost Impact: There is no cost increase associated with this proposal because it only clarifies the existing requirement by consolidating the installation requirements.

RB189-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.2-RB-QUINN-WILSON

RB190 – 13
R322.2.3, Table R322.2.3(1) (New), Table R322.2.3(2) (New), R404.1.3

Proponent: Greg Wilson, US Dept of Homeland Security, Federal Emergency Management Agency (Gregory.P.Wilson@dhs.gov); Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R322.2.3 Foundation design and construction. Foundation walls for all buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 4 subject to the following limitations:

1. Plain masonry walls are not permitted.
2. Masonry walls in flood hazard areas not designated as Coastal A Zones, shall comply with Table R322.2.3(1) or shall be designed in accordance with ASCE 24.
3. Masonry walls in flood hazard areas designated as Coastal A Zones, shall comply with Table R322.2.3(2) or shall be designed in accordance with ASCE 24.

~~**Exception:** Unless designed in accordance with Section 404:~~

~~1. The unsupported height of 6-inch (152 mm) plain masonry walls shall be no more than 3 feet (914 mm).~~
~~2. The unsupported height of 8-inch (203 mm) plain masonry walls shall be no more than 4 feet (1219 mm).~~
~~3. The unsupported height of 8-inch (203 mm) reinforced masonry walls shall be no more than 8 feet (2438 mm).~~

~~For the purpose of this exception, unsupported height is the distance from the finished grade of the under-floor space to the top of the wall.~~

TABLE R322.2.3(1)
MASONRY WALLS IN FLOOD HAZARD AREAS NOT DESIGNATED AS COASTAL A ZONE (ZONE A)

WALL THICKNESS	MAXIMUM UNSUPPORTED WALL HEIGHT[a] (feet)	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[b,c]
8-inch, with reinforcing in accordance with Table R404.1.1(2)	7	#4 at 48
	10	#4 at 24 or #5 at 40
10-inch, with reinforcing in accordance with Table R404.1.1(3)	7	#4 at 56
	10	#4 at 32 or #5 at 48
12-inch, with reinforcing in accordance with Table R404.1.1(4)	7	#4 at 72
	10	#4 at 40 or #5 at 64

a. Unsupported wall height is the distance from the finished interior grade adjacent to the wall, or the footing, whichever is higher, to the top of the wall.
b. If unbalanced fill conditions exist, then vertical reinforcement shall be the greater of that required by this table or referenced table in Section R404 (Tables R404.1.2(2) through R404.1.2(4))

TABLE R322.2.3(2)
MASONRY WALLS IN FLOOD HAZARD AREAS DESIGNATED AS COASTAL A ZONE (ZONE A)

WALL THICKNESS	MAXIMUM UNSUPPORTED WALL HEIGHT[a] (feet)	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)
8-inch, with reinforcing in accordance with Table R404.1.1(2)	2	#4 at 48
	3	#4 at 32 #5 at 48
10-inch, with reinforcing in accordance with Table R404.1.1(3)	4	#4 at 16 #5 at 24
12-inch, with reinforcing in accordance with Table R404.1.1(4)	5	#4 at 8 #6 at 16

a. Unsupported wall height is the distance from the finished interior grade adjacent to the wall, or the footing, whichever is higher, to the top of the wall.

Revise as follows:

R404.1.3 Design required. Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice when one ~~either~~ of the following conditions exists:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top or bottom.
3. Masonry walls in flood hazard areas other than coastal high hazard areas that do not conform to the limitations in of R322.2.3 shall be designed in accordance with ASCE 24.

Reason: Current criteria for prescriptive masonry foundation wall construction per Tables R404.1.1(1) through (4) of Section R404 are based on wall height, soil classification, and unbalanced fill. However, for locations in flood hazard areas when wall sections are analyzed with applicable flood loads, the limits on wall height are typically driven by flood depth (per elevation requirements in R322.2.1) and are less often a function of site grade changes that result in lateral loads from unbalanced fill.

IRC Section R322.2.3 permits construction of masonry foundation walls in flood hazard areas per Section R404 with height restrictions on plain masonry and 8" reinforced masonry walls. The wall height limitations in R322.2.3 are based on analyses performed in 1998 for a range of flood depths and flood velocities. FEMA re-examined those limitations this year after observing wall damage.

Foundation walls in flood hazard areas may be susceptible to hydrostatic forces (addressed by the requirement for flood openings in R322.2.2) and hydrodynamic forces imposed by moving water and moderate breaking wave loads on vertical walls with wave heights between 1 ½ feet and 3 feet (see R322.2, if areas subject to such waves are delineated, they are designated "Coastal A Zones"). FEMA evaluated the resistance of masonry walls of variable heights, with flood openings, to a range of velocities and a range of wave heights, in combination with wind loading conditions covered in the IRC. FEMA used Allowable Stress Design (ASD) Load Combination 7, according to ASCE 7-10 Section 2.4.2 (2).

The hydrodynamic load analyses yielded the proposed wall height limitations and the corresponding minimum vertical reinforcement for 8", 10" and 12" thicknesses. Assumptions included:

1. 1- Story wood-framed residential structure supported on masonry foundation walls with flood openings installed per IRC R322.2.2
2. Top of foundation wall braced by elevated floor system
3. Material strengths per standards referenced in the IRC
4. All wood-frame shear resisting walls are on the exterior; foundation wall shear loads are limited by the capacity of the IRC-compliant light-frame braced walls
5. For analysis of wall sections in Zone A other than Coastal A Zones, the maximum flood velocity evaluated is 6 fps

As an example of how the results of the new analyses demonstrate the need to revise the limitations, the analysis indicates 8" reinforced masonry walls per Table 404.1.1.(2), with minimal reinforcement of #4 bar at 48" on center for an 8 ft high wall have a design strength of 32 ksi in axial tension and flexure. When just an 18" breaking wave load is applied to a 3' high wall at mid-height, the resulting ASD factored force in flexure exceeds 38 ksi.

The analyses also demonstrate the need to specify minimal reinforcement. When wind and flood loads are applied under Allowable Stress Design (ASD) Load Combination 7 per ASCE 7-10 Section 2.4.2 (2), net tension results at the top of the foundation wall from the minimum ASCE 7-10 basic wind speed of 115 mph (Exposure Category B). Higher design wind speeds result in greater uplift. The design criteria of ACI-530 Section 2.2.4 specifies that the tensile strength of unreinforced masonry shall be neglected when subjected to axial tension forces. Accordingly, unreinforced wall sections analyzed with net axial tension at the top of wall from the combined effects of wind and flood loading have been disallowed. ACI-530 commentary to Section 2.2.4 further stipulates, "*Net axial tension in unreinforced masonry walls due to axially applied load are not permitted. If axial tension develops in walls due to uplift of connected roofs or floors, the walls must be reinforced to resist the tension. Compressive stress from dead load can be used to offset axial tension.*"

Evidence from FEMA's post-disaster Mitigation Assessment Team reports indicates residential unreinforced masonry (URM) wall failure under design wind (see FEMA P-908, Spring 2011 Tornadoes) and flood loads (see FEMA P-765, Midwest Floods of 2008 in Iowa and Wisconsin). MAT teams deployed shortly after Hurricane Sandy have documented numerous examples of failed unreinforced and lightly reinforced walls sections in areas shown on Flood Insurance Rate Maps as Zone A, both with and without moderate wave.

Cost Impact: The code change proposal will increase the cost of construction for a limited set of perimeter wall foundations in flood hazard areas, but will reduce the likelihood of failure under anticipated flood loads, and thus will decrease future costs associated with rebuilding after flood and flood/high wind events.

RB190-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.3-RB-OVERCASH-WILSON

RB191 – 13
R322.2.4 (New), R322.3.3, R322.3.4 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

<u>**R322.2.4 Concrete slabs**. Concrete slabs used as parking pads, enclosure floors, landings, decks, walkways, patios and similar uses that are located below the base flood elevation shall be structurally independent of the primary foundation systems of buildings or, where structurally connected, the main structure shall be capable of resisting any added flood loads and effects of scour due to the presence of the slabs.</u>

(Renumber subsequent sections.)

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.4. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section R322.3.6. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section 401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24. ~~Slabs, pools, pool decks and walkways shall be located and constructed to be structurally independent of buildings and structures and their foundations to prevent transfer of flood loads to the buildings and structures during conditions of flooding, scour or erosion from wave-velocity flow conditions, unless the buildings and structures and their foundation are designed to resist the additional flood load.~~

<u>**R322.3.4 Concrete slabs.** Concrete slabs used as parking pads, enclosure floors, landings, decks, walkways, patios and similar uses that are located beneath or adjacent to structures shall be designed and constructed to:</u>

1. <u>Be structurally independent of the primary foundation system of the structure, do not transfer flood loads to the main structure, are constructed to break away cleanly, and are frangible so as to not produce debris capable of causing significant damage to any structure. Reinforcing of concrete slabs, including welded wire reinforcement, shall not be used so as to minimize the potential for concrete slabs being a source of debris. Slabs shall not have turned down edges and slab thickness shall be not more than 4 inches; or</u>
2. <u>Be self-supporting structural slabs capable of remaining intact and functional under base flood conditions, including expected erosion, and the main structure shall be capable of resisting any added flood loads and effects of local scour due to the presence of the slabs.</u>

(Renumber subsequent sections.)

Reason: This proposal includes specifications for concrete slabs that are not found elsewhere in the IRC. Under flood conditions, the presence of concrete slabs can contribute to building damage. The existing language in R322.2 (Zone A) does not provide any specifications and the existing language in R322.3.3 (Zone V) does not provide any specifications for concrete slabs themselves; it only specifies that slabs are to be structurally independent of buildings, unless the buildings are designed to account for the added flood loads. The specific requirements are consistent with revised ASCE 24-13.

Cost Impact: There should be no added cost; the benefits are associated with less potential damage.

RB191-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.4 (NEW) #1-RB-QUINN-WILSON

RB192 – 13
R322.2.4 (New), R322.3.6 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows:

R322.2.4 Decks and porches. Attached and detached decks and porches that are not enclosed by solid, rigid walls and that are located below the elevations specified in Section R322.2.1 shall comply with the following:

1. Attached decks and porches shall be designed to function as a continuation of the building or structure.
2. Detached decks and porches shall be anchored to remain in place during base flood conditions.

R322.3.6 Decks and porches. Attached decks and porches shall meet the elevation requirements of Section R322.3.2 and shall meet the foundation requirements of this section or be cantilevered from or knee braced to the building or structure. Detached decks and patios that are below the elevation requirements of Section R322.3.2 shall not be enclosed by solid, rigid walls, including walls designed to break away. Detached decks and patios shall be designed and constructed to remain intact and shall be anchored to remain in place during base flood conditions, or shall be frangible and break away cleanly so as not to produce debris capable of causing significant damage to any structure.

Reason: The IRC does not have specific requirements for decks and porches that are common elements for dwellings. These same requirements are included in ASCE 24-13.

Attached decks and porches can be elevated to the same requirements as dwellings. If not elevated, they can contribute to loads on buildings under flood conditions, so the buildings should be designed to account for those added loads. Decks and patios can be detached (structurally independent), in which case they can be below the elevation of buildings (provide they are not enclosed with walls – screen and lattice are not walls for this purpose). Detached decks and patios either have to be anchored so they don't become large debris that can batter other buildings or block drainage structures.

Cost Impact: Electing to structurally attach decks or patios would likely increase foundation costs, but the alternative is to choose to use detached decks and patios. Decks and patios are structures and have always been subject to the general NFIP requirement to be constructed by methods and practices that minimize flood damage and to be stable under flood conditions, both are included in the IRC at R322.1.2 and R322.1.3.

RB192-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.4 (NEW) #2-RB-QUINN

RB193 – 13
R322.2.4 (New), R322.3.7 (New), M2201.6

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows:

R322.2.4 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.2.1 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood and shall be protected from impact by floating debris.

R322.3.7 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.3.2. Where elevated on platforms, the platforms shall conform to the foundation requirements of Section R322.3.

Revise as follows:

M2201.6 Flood-resistant installation. In flood hazard areas as established by Table R301.2(1), tanks shall be installed in accordance with Section R322.2.4 (flood hazard areas including Zone A) or Section R322.3.7 (coastal high-hazard areas including Zone V). ~~at or above the elevation required in Section R322.2.1 or R322.3.2 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the design flood.~~

Reason: This proposal more clearly separates underground tanks from above-ground tanks. Dislodged tanks not only can release contents into floodwaters, but they become battering debris that can contribute to structural damage.

Underground tanks need to be installed in ways that take into consideration the fact that soils may be saturated during flooding, creating conditions that can cause tanks to be dislodged. This occurs after many flood events; most recently, problems with tanks were observed throughout the Hurricane Sandy impact area.

How above-ground tanks that serve dwellings are handled depends on flood zone. In coastal high hazard areas (Zone V) above-ground tanks have to be elevated – they may be elevated on separate platforms or on platforms that are cantilevered from the elevated building/foundation. In other flood hazard areas (Zone A) above-ground tanks may be elevated, or may be below base flood elevation, provided they are adequately anchored.

These same requirements are included in ASCE 24-13. The NFIP considers tanks as structures and structures have always been subject to the general NFIP requirement to be constructed by methods and practices that minimize flood damage and to be stable under flood conditions, both are included in the IRC at R322.1.2 and R322.1.3.

Cost Impact: None. These requirements articulate how the basic NFIP requirements (and the requirements of R322) should have been applied.

RB193-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.2.4 (NEW) #3-RB-QUINN-WILSON

RB194 – 13
R322.3.2

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high-hazard areas shall be elevated so that the <u>bottom of the</u> lowest ~~portion of all~~ <u>horizontal</u> structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is <u>elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.</u>
   ~~1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees (0.35 rad) from the direction of approach, or~~
   ~~1.2 Located at the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees (0.35 rad) from the direction of approach.~~
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.

   Exception: Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.

Reason: This proposal simplifies application of the elevation requirement in coastal high hazard areas (Zone V) by eliminating different elevation requirements as a function of orientation of the lowest horizontal structural member. FEMA determines BFEs based on many assumptions about waves. Not accounted for in those assumptions is the observation that under base flood conditions some wave crests are higher than estimated. Even the occasional wave impacting the lowest horizontal structural member imparts significant load that can lead to structural damage. In practice, determining the direction of wave approach is difficult at best, especially since wave approach varies through the storm cycle when storms move on paths along the shoreline rather than approach the shore directly. This proposal eliminates the distinction based on orientation but retains the requirement for additional elevation to account for wave crests that exceed the BFE, even under base flood conditions. The revised ASCE 24-13 also eliminates orientation as a factor to determine elevation.
For additional discussion about the benefits of elevation to BFE + 1 ft, see reason statement submitted for a separate proposal to add + 1 ft to all elevation requirements.

Cost Impact: There is a minimal cost increase for homes to be elevated one additional foot, but that increase is offset over a relatively short time by reduced damage and by the lower annual flood insurance premiums that will be charged to all future owners of the home. An independent economic analysis determined the payback period for the incremental cost to add one additional foot to a piling or column foundation is about 4 years. See "Evaluation of the National Flood Insurance Program's Building Standards," http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-evaluation

RB194-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.3.2 #1-RB-QUINN-WILSON

RB195 – 13
R322.3.2

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high-hazard areas shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is:
   1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees (0.35 rad) from the direction of approach, or
   1.2 Located at the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees (0.35 rad) from the direction of approach.
2. Basement floors that are below grade on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.

   ~~**Exception:** Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.~~

Reason: This is only a format change, so that the provision is part of the requirements and not an exception. Because there are other items in this requirement that are not subject to elevation requirements (see #3 and #4), there is no reason why the requirements for walls should be written as an exception.

Cost Impact: None; no change in requirements.

RB195-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.3.2 #2-RB-QUINN-WILSON

RB196 – 13
R322.3.4

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows:

R322.3.4 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (470 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared and sealed by a registered design professional that:
   4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.
   4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.
5. Walls intended to break away under flood loads as specified in Items 3 or 4 have flood openings that meet the criteria in Section R322.2.2(2).

Reason: Breakaway walls are intended to fail under wave loads. However, experience shows that walls are breaking away under water depths and wave conditions that are less than the water depths and waves expected during the base flood. Having openings will permit the water level inside to match the water level outside, limiting failure under "shallow" flooding that occurs more frequently than the base (100-year) flood. These same requirements are included in ASCE 24-13.
Homes that are built with enclosures surrounded by breakaway walls with flood openings will sustain damage less frequently, not only to the walls themselves, but the interior of the enclosures won't be exposed to wind-driven rain and sand. In addition, with fewer wall failures there will be less debris added to floodwaters and waves which will reduce damage by battering. FEMA guidance for home builders advises use of flood openings in breakaway walls to relieve flood forces and reduce damage to walls (FEMA P-499, Fact Sheet 8.1).

Cost Impact: The additional cost to install flood openings will be offset by less frequent failure of breakaway walls. NFIP flood insurance policies do not cover claims for damage to the walls, which means owners have to bear the full cost of reconstructing breakaway walls frequently, if the walls fail under less than base flood conditions.

RB196-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.3.4 #1-RB-QUINN-WILSON

RB197 – 13
R322.3.4

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

R322.3.4 Walls below design flood elevation. Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a ~~design safe loading~~ resistance of not less than 10 (470 Pa) and no more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa) as determined using allowable stress design, the construction documents shall include documentation prepared and sealed by a registered design professional that:
   4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the base ~~design~~ flood.
   4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values used shall be those required by this code.

Reason: This proposal clarifies that the method used to determine breakaway wall resistance is the "allowable stress design," making it consistent with language used in IBC Sec. 1612.5(2.3) where a design profession is required to certified "breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using allowable stress design."

Cost Impact: No cost impact.

RB197-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.3.4 #2-RB-QUINN-WILSON

RB198_ – 13
R322.3.5.1 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Add new text as follows:

R322.3.5.1 Protection of building envelope. An exterior door that meets the requirements of Section R612 shall be installed at the top of stairs that are enclosed with walls designed to break away in accordance with Section R322.3.4.

Reason: Walls below elevated buildings in coastal high hazard areas (Zone V) are permitted if the area enclosed by walls is used for parking of vehicles, building access or storage. If the enclosed area is used for building access, then a stairway provides access to the elevated building. R322.3.4 requires the walls to be designed and constructed to break away under flood loads. Post-disaster investigations have identified increased damage to the interior of elevated buildings because wave splash, wave run-up, and wind-driven rain can enter buildings through the unprotected doorway at the top of the stairs.

Cost Impact: The added cost of an exterior door is offset by reduced damage caused by wave splash, wave run-up, and wind-driven rain, some of which is not covered by NFIP flood insurance.

RB198-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R322.3.5.1 (NEW)-RB-QUINN-WILSON

RB199 – 13
R323

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

~~SECTION R323~~
<u>APPENDIX R</u>
STORM SHELTERS

~~R323.1~~ <u>AR101.1</u> General. This section applies to the construction of storm shelters when constructed as separate detached buildings or when constructed as safe rooms within buildings for the purpose of providing safe refuge from storms that produce high winds, such as tornados and hurricanes. In addition to other applicable requirements in this code, storm shelters shall be constructed in accordance with ICC/NSSA-500.

Reason: Section R323.1 is a new addition to the 2012 IRC. This section intends to make sure that if a storm shelter or safe room is built it will provide "safe refuge from storms that produce high winds, such as tornados and hurricanes." ***Storm shelters*** are separate detached buildings; ***safe rooms*** are rooms inside a dwelling, usually a bathroom, walk-in closet, or utility room that are reinforced to withstand high winds and wind borne debris. R323.1 of the 2012 IRC does not require IRC dwellings to include a storm shelter or safe room. But if a homeowner or builder decides to build a safe room this new section of the code makes sure they are built to the specifications of ICC/NSSA 500.

ICC/NSSA 500 is co-published by the International Code Council and the National Storm Shelter Association. It is a technical document that has precise requirements for safe rooms in homes designed to resist tornados. For instance, the walls and doors of a safe room meeting ICC/NSSA 500 must withstand wind gusts of 250 mph and horizontal wind borne debris of 100 mph. To meet this design standard, safe room designs or its components are tested and pass the projectile test by launching a 15 lb. 2x4 at 100 mph at the safe room's walls and doors.

Sometimes new code language written with the best intentions produces the exact opposite effect when enforced in the "real world" of construction. The new safe room amendment is an example.

Very infrequently a homeowner will ask their builder or remodeler to install a room to help protect their family from tornados or other severe wind storms. The builder will add reinforced walls to a bathroom, walk-in closet or utility room using building techniques recommended by the Federal Emergency Management Agency. These added safety features significantly increase the likelihood that family members will survive a severe weather event if they have enough warning to be in the safe room when the storm hits. These rooms would not be consider "safe rooms" because they would not meet all of the ICC/NSSA 500 standards required by R323.1, only some of them. Why? Because the vast majority of homeowners are unwilling to pay for the following upgrades required by the ICC/NSSA 500 standard:

- 3 - grade 1 commercial deadbolts with 1" bolt throws
- A 12 gauge welded steel door frame with welded mitered corners and 7 gauge lock reinforcements
- 5 anchor points at each jamb and 3 points of attachment to frame stiffeners in the door head
- A steel door with a 14 gauge skin and a honeycomb core or equivalent
- 2-4 square inches of natural ventilation per occupant
- A minimum of 3 sq. ft. of area for each occupant.

In fact, this new code amendment would require a building code official to enforce every provision of ICC/NSSA 500 if it looks like a homebuilder or remodeler's plans include reinforced walls in one room in a house. The result? Homeowners will never ask to include a "safe room" in their home because they are unwilling to upgrade to a ICC/NSSA 500 certified "safe room." This code section should be moved to the appendix where it can be used as a guide rather than as a mandatory requirement for those areas of the country where these structures are not required.

This proposal is necessary because it allows a homeowner to install certain elements to make their homes safer without the need to upgrade the home to a standard that is not required in the first place. The proposal is reasonable because it still permits safer elements and encourages uniformity.

Cost Impact: None

RB199-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R323-RB-DAVIDSON

RB200 – 13
R324 (New), R325 (New), R326 (New), R327 (New), R328 (New)

Proponent: Ali M. Fattah, P.E., City of San Diego, representing the San Diego Area Chapter of ICC (afattah@sandiego.gov)

Add new text as follows:

R324 Structural Tests and Special Inspections. Where structural tests and special inspections are required due to the methods of construction, the tests and inspections shall be performed and documented as is required in Chapter 17 of the *International Building Code*.

R325 Swimming Pool Enclosures and Safety Devices. Swimming pools shall comply with the requirements of Sections 3109.2 through 3109.5 and other applicable sections of the *International Building Code*.

R326 Encroachments Into The Public Right-Of- Way. Encroachments into the Public Right-of-Way shall comply with the standards in Chapter 32 of the *International Building Code*.

R327 Safeguards During Construction Provisions for safety during construction and the protection of adjacent public and private properties shall be governed by the requirements of Chapter 33 of the *International Building Code*.

R328 Sound Transmission. Wall and floor-ceiling assemblies separating dwelling units from each other shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies as required in Chapter 12 of the *International Building Code*.

Reason: The IRC is developed as a standalone code however it does not address certain issues regulated by the International Building Code. This code change provides a cross reference to the IBC in lieu of adopting IBC regulations by transcription. The IRC allows multi-unit dwellings and townhouses but does not address sound transmission control between dwelling units and townhouses. Additionally the IRC does not seem to regulate swimming pools, encroachments into the public right of way or safety during construction.

Section R324 is necessary since special inspections and tests may be required by product evaluation reports or due to non-conforming construction that was approved to comply with the IRC may need to be qualified by testing.

Cost Impact: This code change will not increase the cost of construction.

RB200-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R324 (NEW)-RB-FATTAH

RB201 – 13
R324 (New), R202, Chapter 44

Proponent: David P. Kapturowski representing the American Association of Radon Scientist & Technologists

Add new text as follows:

SECTION R324
RADON REDUCTION

R324.1 General. This Section applies to radon control methods for buildings and structures within EPA Radon Zones 1 & 2, as defined in Section R324.42. *Rough-Ins* or complete *Active Soil Depressurization* (ASD) systems shall be installed as necessary to reduce soil gas entry and vapor intrusion so as to establish indoor radon levels below the *National Radon Action Level* (NRAL).

R324.2 Mitigation system required. A *mitigation system Rough-In* shall be installed in *dwellings* located in *radon* potential zones 1 and 2 in accordance with Section R324.8. The *radon* potential zones shall be determined in accordance with Section R324.42.

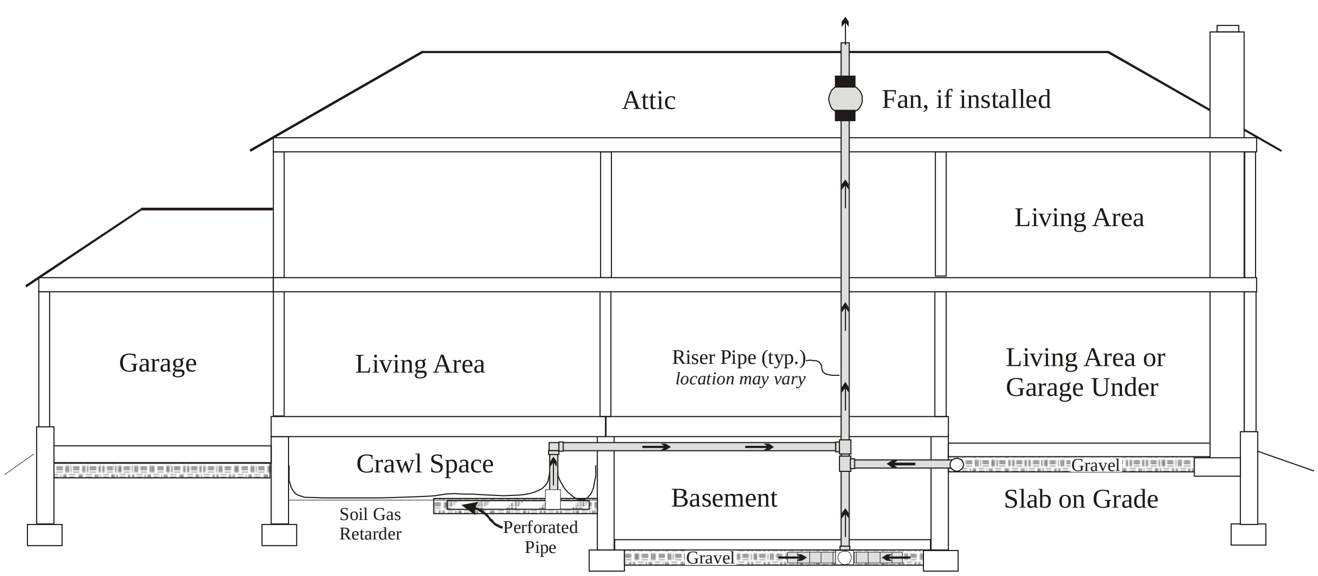
> **Exception:** Where the foundation system does not have any enclosed area of soil contact and where prior to occupancy, testing in accordance with Section R324.41 indicates that the building has a *radon* level below the *National Action Level* (*NAL*).

R324.3 Design. The design of *radon mitigation systems* shall comply with Section R324 and, for buildings having a total foundation area of greater than 2500 square feet [232 sq. m], shall be performed by a *mitigator* who is *certified* or *licensed* to design such systems. Designs of *radon mitigation systems* for foundation types other than those specified herein shall be performed by a *mitigator* who is *certified* or *licensed* to design such systems.

R324.4 Foundation area. The foundation area shall be calculated from the inside perimeter dimensions of the foundation walls.

R324.5 Mitigation system rough-in required. The *Rough-In* installation of a *mitigation system* shall be required for all foundations and *combination foundations* types, including *crawl space*, basement, slab-on-grade and slab-on-grade garage located below a living area. The installation shall be in accordance with Sections R324.6 through R324.28. Figure R324.5 illustrates the four foundation types.

FIGURE R324.5
FOUNDATION TYPES



R324.6 Soil gas collection plenums. Foundation areas shall be constructed so as to create sealed *soil gas collection plenums* in accordance with Sections R324.7 through R324.9.6.

R324.7 Submembrane soil gas collection plenums in crawl spaces with earthen floors. For each *suction point*, a *soil gas collector* shall be installed in accordance with Sections R324.7.1 through R324.7.7 and Section R324.9.

R324.7.1 Soil gas collector. One *soil gas collector* for each *suction point* in accordance with Section R324.7.1.1 shall be installed in accordance with Section R324.7.1.1, R324.7.1.2 or R324.7.1.3.

R324.7.1.1 Pipe soil gas collector. The *soil gas collector* shall consist of a perforated pipe with a nominal diameter of not less than 4 inches [102 mm]. The pipe shall be not less than 10 feet [3048 mm] in length. Such piping shall be placed in a trench backfilled with clean aggregate meeting the criteria of Section R324.8.1.1.1 such that the pipe is completely surrounded by not less than 4 inches [102 mm] of aggregate.

R324.7.1.1.2 Geotextile soil gas collector. The *soil gas collector* shall consist of a strip of geotextile drain matting not less than 10 feet [3048 mm] in length and having a cross sectional area of not less than 12 square inches [7742 sq. mm]. The strip of matting shall be placed on top of the soil or in a trench.

R324.7.1.1.3 Gravel soil gas collector. A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or shall be in accordance with Size Number 4, 5, 56, or 6 as classified by ASTM C33.

R324.7.2 Suction points. One *suction point* shall be provided for each *soil gas collector*. *Suction points* shall be installed in accordance with Section R324.7.2.1, R324.7.2.2 or R324.7.2.3, as applicable for the type of plenum installed.

R324.7.2.1 Suction point for pipe soil gas collector. The *suction point* for a pipe *soil gas collector* shall consist of a pipe fitting or other device having not less than three openings with two openings oriented so as to create multiple horizontal intake openings. The perforated pipe plenum shall be inserted into both of the horizontal openings of the pipe fitting or device. One opening of the fitting or device shall be oriented in a vertical “up” position. Alternatively, the sub-membrane area and the other foundation types shall be interconnected by a *pipe loop soil gas collector* that is constructed in accordance with Section R324.8.1.1.3 and served by one or more *suction points*.

R324.7.2.2 Suction point for geotextile soil gas collector. The *suction point* for a geotextile *soil gas collector* shall consist of a pipe fitting or other device having not less than three openings with two openings oriented so as to create multiple horizontal intake openings. The horizontal openings shall be connected to the matting in a manner to facilitate airflow from the collector. One opening of the fitting or device shall be oriented in a vertical “up” position.

R324.7.2.3 Suction point for gravel soil gas collector. The *suction point* for a *gravel soil gas collector* shall consist of a pipe fitting or other device having not less than three openings with two openings oriented so as to create multiple horizontal intake openings. The horizontal openings shall be provided with not less than 5 feet [1524 mm] of perforated pipe extending from each opening of the fitting or device into the *gravel* layer. Such perforated pipe shall provide not less than 1 square inch [645 sq. mm] of open perforation area per lineal foot of pipe.

R324.7.3 Suction points not permitted. *Suction points* are not permitted on sump lids

R324.7.4 Fasten suction points. *Suction point* fittings and devices shall be fixed in place to prevent dislocation.

R324.7.5 Seal top of the soil gas collection plenum. A *soil gas retarder* shall cover the top of the *soil gas collection plenum* and all exposed soil. The installation of the *soil gas retarder* shall be in accordance with Sections R324.7.5.1 through R324.7.5.4.

R324.7.5.1 Sheeting. The *soil gas retarder* membrane shall meet ASTM E1745 Class A, B or C.

R324.7.5.2 Seams. The seams between adjacent membrane sheets shall be overlapped not less than 12 inches [305 mm] and shall be sealed by one of the following methods:

1. A tape recommended by the membrane manufacturer.
2. Caulk complying with ASTM C920 class 25 or greater.
3. An equivalent method.

R324.7.5.3 Repairs. Tears or punctures in the membrane shall be sealed by one or more of the following methods:

1. A tape recommended by the membrane manufacturer.
2. An additional sheet of the membrane material that covers and overlaps the tear or puncture not less than 12 inches [305 mm] on all sides and that is sealed with a caulk complying with ASTM C920 class 25 or greater.
3. An equivalent method.

R324.7.5.4 Penetrations. Openings in the *soil gas retarder* membrane for piping, utilities, structural supports or similar penetrations shall be sealed.

R324.7.6 Seal sides of the soil gas collection plenum. The *soil gas retarder* membrane shall turn up onto foundation walls not less than 6 inches [152 mm] and shall be continuously sealed to the wall along the full perimeter with a caulk complying with ASTM C920 class 25 or higher or equivalent method.

R324.7.7 Membrane label required. *Soil gas retarder* membranes shall be marked in a conspicuous place with a label to identify that the membrane is a component of a *radon* reduction system. The label lettering shall be not less than 1/4 inch [6.35 mm] in height and shall be of a color in contrast to the color of the background on which the lettering is applied.

R324.8 Subslab soil gas collection plenums for concrete floors. The floors of basement, concrete crawlspace and slab-on-grade foundation systems shall be provided with a *soil gas collection plenum* installed in accordance with Sections R324.8.1 through R324.9.6.

R324.8.1 Soil gas collector. A *soil gas collector* shall be installed in accordance with Section R324.8.1.1, R324.8.1.2 or R324.8.1.3.

R324.8.1.1 Gravel. A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or shall be in accordance with Size Number 4, 5, 56, or 6 as classified by ASTM C33.

R324.8.1.2 Geotextile. A layer of geotextile drainage matting shall be placed over a uniform layer of either soil or sand. The geotextile drainage matting shall be designed to allow the lateral flow of *soil gases* to the system's *suction point* fitting. The *geotextile matting* shall have a cross-sectional area of not less than 12 square inches [7742 sq. mm] and shall be placed, at a minimum, along the entire inside perimeter of the foundation at a distance of 12 inches [305 mm] to 18 inches [457 mm] from the foundation wall to the edge of the drainage matting. Deviation from the 12 inch [305 mm] to 18 inch [457 mm] distance to the foundation wall shall be allowed to avoid obstacles such as plumbing and other utilities.

R324.8.1.3 Pipe loop. A loop of not less than 4 inch [102 mm] diameter perforated pipe shall be placed along the entire inside perimeter of the foundation at a distance of 12 inches [305 mm] to 18 inches [457 mm] from the centerline of the pipe to the foundation walls. Such piping shall be placed in a trench backfilled with clean aggregate meeting the criteria of Section R324.8.1.1 and surrounding the pipe on at least 2 sides. The cross-sectional area of the aggregate and pipe *soil gas collector* shall be not less than 50 square inches [32,258 sq. mm]. The piping shall form a continuous loop and pipe sections shall be joined with a connector device or method recommended by the manufacturer. Deviation from the 12 inch [305 mm] to 18 inch [457 mm] distance to the foundation wall shall be allowed to avoid obstacles such as plumbing and other utilities.

R324.8.2 Suction points. One *suction point* shall be provided for each *soil gas collector*. Not less than one *suction point* shall be provided for each foundation type. Alternatively, each *soil gas collector* shall be interconnected by a *pipe loop soil gas collector* that is constructed in accordance with Section R324.8.3 and served by one or more *suction points*. *Suction points* shall be installed in accordance with Sections R324.8.2.1, R324.8.2.2 or R324.8.2.3 as applicable for the type of *soil gas collector* installed.

R324.8.2.1 Gravel layer soil gas collector. A *suction point* for a *gravel* type *soil gas collector* shall consist of a pipe fitting or other device having not less than two openings oriented so as to create multiple horizontal intake openings within the *gravel* layer. The horizontal openings shall be provided with not less than 5 feet [1534 mm] of perforated pipe extending from each opening of the fitting or device into the *gravel* layer. Said perforated pipe shall provide a not less than 1 square inch [645 sq. mm] of open perforation area per lineal foot of pipe. *Suction point* openings above the slab shall be protected from the entry of aggregate, concrete and debris.

R324.8.2.2 Geotextile layer soil gas collector. A *suction point* for a geotextile type *soil gas collector* shall consist of a pipe fitting or other device having not less than three openings with two oriented so as to create multiple horizontal intake openings connected to the geotextile mat in a manner to maintain airflow capacity from the plenum. *Suction point* openings above the slab shall be protected from the entry of aggregate, concrete and debris.

R324.8.2.3 Pipe loop soil gas collector. A *suction point* for a *pipe loop* type collector shall consist of a pipe tee fitting or pipe saddle device installed in the loop piping. *Suction point* openings above the slab shall be protected from the entry of aggregate, concrete and debris.

R324.8.3 Multiple soil gas collection plenums. Where interior footings divide a *soil gas collector* into two or more areas, each such area shall be provided with the required *suction points* and joined with *mitigation system* piping in accordance with Section R324.10. Alternatively, each area so created by the interior footings shall be interconnected by a *pipe loop soil gas collector* that is constructed in accordance with Section R324.8.1.3 and served by one or more *suction points*.

R324.8.4 Suction points not permitted. *Suction points* are not permitted on sump lids.

R324.8.5 Fasten suction points. *Suction point* fittings and piping shall be fastened in place to prevent dislocation during placement of the gas permeable layer, *soil gas retarder* and concrete.

R324.8.6 Seal top of the soil gas plenum. The *soil gas collector* and all exposed soil shall be covered with a *soil gas retarder* installed in accordance with Section R324.8.6.1.

R324.8.6.1 Sheeting. Polyethylene sheeting of not less than 6 *mils* [0.152 mm] in thickness, or cross-laminated polyethylene sheeting of not less than 3 *mils* [0.076 mm] in thickness shall be installed on top of the *soil gas collector* and shall completely cover the area under the concrete floor and shall be sealed in accordance with Sections R324.8.6.1.1 through R324.8.6.1.3. Where sheet foam board insulation is installed on top of the *soil gas collector*, the polyethylene sheeting shall be installed below the foam board insulation.

R324.11.8.1.1 Seams. Seams between adjacent polyethylene sheets shall be overlapped not less than 12 inches [305 mm] and sealed with a caulk complying with ASTM C920 class 25 or higher, or equivalent method.

R324.11.8.1.2 Repairs. Tears or punctures in the polyethylene sheeting shall be sealed or an additional sheet of polyethylene shall cover the tear or puncture with an overlap of not less than 12 inches [305 mm] on all sides. Such additional sheet shall be sealed and fixed in place to prevent displacement during slab casting.

R324.11.8.1.3 Penetrations. Openings in the *soil gas retarder* membrane for piping, utilities, structural posts and similar penetrations shall be sealed.

R324.8.7 Concrete floors. The concrete floor shall be cast directly upon the *soil gas retarder* or upon the sheet foam board insulation where it is installed on top of the *soil gas retarder*.

R324.8.8 Penetrations. Penetrations through the concrete slab and *soil gas retarder* shall be sealed with a caulk complying with ASTM C920 class 25 or higher, or equivalent method.

R324.8.9 Block-outs. Where openings are cast or constructed in the concrete slab under plumbing fixtures, the openings shall be filled with expanding foam or a non-shrink grout or an approved equivalent method. Exposed openings shall be sealed with non-shrink grout or an approved equivalent method.

R324.8.10 Seal sides of the soil gas collection plenum. The intersection of floors and foundation walls shall be sealed with a caulk complying with ASTM C920 class 25 or higher or an approved equivalent method. Sealing shall be performed in accordance with Section R324.8.10.1, R324.8.10.2 or R324.8.10.3.

R324.8.10.1 Seal floor to wall. The intersection of floors and foundation walls shall be sealed.

R324.8.10.2 Seal soil gas retarder to footing or wall. Where foundation walls are solid concrete, the *soil gas retarder* shall be sealed to the footing or to the foundation wall.

R324.8.10.3 Seal soil gas retarder to wall. Where foundation walls are masonry block, the *soil gas retarder* shall be sealed to the foundation wall.

R324.9 General sealing of soil gas collection plenums. Sealing of potential *soil gas* pathways shall be in accordance with Sections R324.9.1 through R324.9.6.

R324.9.1 Sumps in floors. Sumps in interior floors shall have a rigid lid and the lid shall be sealed with a gasket or silicone caulk and mechanically fastened in a manner to facilitate removal for maintenance. Pipe and wiring penetrations through the lid shall be sealed. The intersection of the floor and sump basin shall be sealed with a caulk complying with ASTM C920 class 25 or higher or equivalent method.

R324.9.2 Hollow masonry unit walls. The top course of hollow block masonry walls shall be made of solid masonry units or the top course shall be fully grouted. The top course under the full width of door and window openings shall be made of solid masonry units or the hollow masonry units shall be fully grouted. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be made of solid masonry units or the top course shall be fully grouted**.** Other penetrations through foundation walls shall be sealed**.**

R324.9.3 Floor drains. Floor drains and condensate drains shall not allow *soil gas* entry.

R324.9.4 Air ducts. Air ducts located below concrete slabs shall be sealed to prevent *radon* entry and constructed in accordance with Chapter 16.

R324.9.5 Foundation drains. Gravity foundation drainage systems shall include a *check valve* or other mechanical means to isolate the *soil gas collection plenum* from any exterior drain piping. Access shall be provided for maintenance.

R324.9.6 Access openings. Access openings in the floor provided for drain maintenance shall not allow *soil gas* entry.

R324.10 Mitigation system piping. The *mitigation system* piping that extends from the *soil gas* plenum to the point of discharge shall be rigid, non-perforated pipe in accordance with Sections R324.11 through R324.19.

R324.11 Pipe size. *Mitigation system* pipe shall be not less than 3 inch [76 mm] nominal inside diameter.

R324.12 ABS piping. ABS pipe shall comply with ASTM D2661, F628 or F1488. The pipe wall thickness shall be Schedule 40.

R324.13 PVC piping. PVC pipe shall comply with ASTM D2665, F891, or F1488. The pipe wall thickness shall be Schedule 40.

> **Exception:** Rigid, non-perforated PVC pipe meeting ASTM D2949 shall be an alternative to the material specified herein, where installed vertically within enclosed wall cavities.

R324.14 Slope. Above ground piping shall have a slope of not less than 1/8 inch [3.2 mm] per foot [305 mm]. Piping shall slope downwards towards the *suction point*. Piping arrangements that could allow water to collect are prohibited.

R324.15 Joints. Plastic pipe joints shall be solvent welded in accordance with Sections R324.15.1 and R324.15.2. Where disassembly of piping is required such as for removal of a fan, the joints shall be made with flexible couplings complying with ASTM D5926 or ASTM C1173 or an approved equivalent method.

R324.15.1 ABS plastic pipe joints. ABS plastic pipe joints shall be solvent welded in accordance with the pipe manufacturer's instructions with solvent cement conforming to ASTM D 2235.

R324.15.2 PVC plastic pipe joints. The joint surfaces for PVC plastic pipe and fittings to be solvent welded shall be prepared with a primer conforming to ASTM F 656. PVC plastic pipe joints shall be solvent welded in accordance with the pipe manufacturer's instructions with solvent cement conforming to ASTM D 2564.

R324.16 Support. Above ground piping shall be supported by the structure of the building using hangers or strapping designed for piping support. Supports for horizontal piping shall be installed at intervals of not more than 4 feet [1219 mm] and supports for vertical piping shall be installed at intervals of not more than 10 feet [3048 mm].

R324.17 Protection against physical damage. Where pipes penetrate top or bottom plates of stud walls and the nearest edge of the hole is within 1 ½ inches [38 mm] of the face of the member, the pipe shall be protected by steel shield plates. Such shield plates shall have a thickness of not less than 0.0575 inches [1.463 mm] (No. 16 gage). Such plates shall cover the area of the pipe where the plate is bored, and shall extend not less than 2 inches [51 mm] above bottom plates and not less than 2 inches [51 mm] below top plates.

R324.18 Insulation required. In spaces where *mitigation system* piping is subject to freezing temperatures and in spaces where the exterior of *mitigation system* piping is subject to the formation of condensation, such piping shall be provided with insulation having an external vapor barrier and an R-value of not less than 1.8.

R324.19 Labels required (piping). *Mitigation system* piping shall be marked prior to the closing of wall cavities with not less than one label at each floor level and at intervals not more than 10 feet [3048 mm] along the developed length of the piping. The label shall identify that the item is a component of a *radon* reduction system. The label lettering shall be not less than 1/4 inch [6.35 mm] in height and shall be of a color in contrast to the color of the background on which the lettering is applied.

R324.20 Mitigation system termination. The discharge point of a *mitigation system* shall be to the outdoors and shall be directed vertically upward.

R324.21 Elevation and vertical walls. The point of discharge of a *mitigation system* shall comply with all of the following:

1. It shall be not less than 1 foot [305 mm] above the roof at the point penetrated.
2. It shall be not less than 10 feet [3048 mm] above grade nearest the point of discharge.
3. It shall be not less than 10 feet [3048 mm] horizontally from a vertical wall that extends above the roof penetrated.

R324.22 Windows and doors. The discharge point of a *mitigation system* shall be not less than 2 feet [610 mm] above or not less than 10 feet [3048 mm] from windows, doors or other gravity intake openings into the structure or an adjacent structure excluding attic ventilation openings. The 10 foot [3048 mm] distance shall be measured around intervening obstacles.

R324.23 Equipment air intake. The discharge point of a *mitigation system* shall be not less than 3 feet [914 mm] above or 10 feet [3048 mm] away from mechanical air intake openings such as those for evaporative coolers, make-up air, and heat energy recovery ventilators. The 10 foot [3048 mm] distance shall be measured around intervening obstacles.

R324.24 Provision for Active Soil Depressurization (ASD) fan. A space having a vertical height of not less than 48 inches [1219 mm] and a diameter of not less than 21 inches [533 mm] shall be provided in the area where the *ASD fan* will be installed if required. The space provided for the *ASD fan* shall be located according to Section 901.8. The *ASD* pipe shall be centered in this space.

R324.25 Electrical. A receptacle outlet supplied by branch circuit conductors shall be located within 6 feet [1.8 m] of an interior *ASD fan* location

R324.25.1 Label. The over-current device for the branch circuit supplying the *ASD fan* shall be labeled to indicate that it supplies the *radon* fan.

R324.25.2 Disconnect required. Where the fan is not cord and plug connected, a means of electrical disconnect shall be provided for and in sight of the *ASD fan*. The electrical disconnect shall be labeled as to its purpose.

R324.26 Fan access. Limited *access* shall be provided for each *ASD fan* location to allow installation of *ASD fans* and replacement of same. *Access* entry shall be located not more than 20 feet [6096 mm] from the *ASD fan* location.

R324.27 Radon test kit required. A minimum of one long term *radon*-in-air test kit from a *certified* and/or *licensed* laboratory shall be provided for the occupants of each *dwelling* unit.

R324.28 Completion of ASD system. Prior to occupancy, the *ASD* system shall be completed and activated in accordance with Sections R324.30 through R324.41.

> **Exception:** Where prior to occupancy, testing in accordance with Section R324.41 indicates that the building has a *radon* level below the *National Action Level* (*NAL*) and the *Rough-In* piping is labeled in accordance with Section R324.29.

R324.29 Labels required, system Rough-in. *Mitigation system* piping shall be marked with not less than one label in a conspicuous location. An additional label shall be placed on or within 12 inches [305 mm] of the electrical service panel. The labels shall state the following: **"**This radon system is nonfunctional because the system has NOT been activated with a radon fan. The building should be tested for radon at least every 2 years or as recommended by the state or USEPA." The label lettering shall be of a height of not less than 1/4 inch [6.35 mm] and shall be of a color that is in contrast to the color of the background on which the lettering is applied.

R324.30 Fan selection. Fans installed in the *ASD* system shall be recommended by the manufacturer for *radon* mitigation. Such fans shall be designed and sealed by the manufacturer to minimize leakage of water or *soil gas* from the fan housing and shall be sized in accordance with Table R324.33 or as specified by a *certified* or *licensed radon mitigator*.

TABLE R324.30
FAN SIZING

PIPE SIZE Nominal (I.D.)	**TOTAL FOUNDATION AREA**		
	Less Than 1600 sq. feet	**1600 to 2500 sq. feet**	**Greater than 2500 sq. feet**
	Less Than 149 sq. meters	**149 to 232 sq. meters**	**Greater than 232 sq. meters**
(3 inch) [76 mm]	Use Radon Fan Type: **RF1** RF1 Minimum rating:[a] 50 *cfm* @ 0.5 *in. WC* [85m^3/hr @ 125 *Pa*]	Use Radon Fan Type: **RF2** RF2 Minimum rating:[a] 75 *cfm* @ 1.0 *in. WC* [127m^3/hr @ 250 *Pa*]	*Radon* fan to be sized by *certified* and/or *licensed radon mitigator*
(4 inch) [102 mm]	Use Radon Fan Type: **RF1** RF1 Minimum rating:[a] 50 *cfm* @ 0.5 *in. WC* [85m^3/hr @ 125 *Pa*]	Use Radon Fan Type: **RF1** RF1 Minimum rating:[a] 50 *cfm* @ 0.5 *in. WC* [85m^3/hr @ 125 *Pa*]	*Radon* fan to be sized by *certified* and/or *licensed radon mitigator*

a. Radon Fan Types RF1 & RF2 minimum flow and pressure ratings are manufacturer specifications.

R324.31 Orientation. *ASD* inline fans shall be installed only on vertical *ASD* piping.

R324.32 Installation. *ASD fans* shall be installed in accordance with the manufacturer's instructions.

R324.33 Flexible connectors required. *ASD fans* shall be connected to the *ASD* piping using flexible unshielded couplings complying with ASTM D5926 or ASTM C1173 or an equivalent method. Connections shall be air and water-tight.

R324.34 Fan start-up. *ASD fans* shall be electrically energized upon installation on the *ASD* system piping.

R324.35 Fan location. *ASD fans* shall be installed only outdoors, in attics or in garages that are not beneath conditioned spaces. *ASD fans* shall not be installed below ground, in conditioned spaces, in occupiable spaces of a building or in a basement, crawlspace or other interior location that is directly beneath a conditioned or occupiable space of a building. *ASD fans* shall not be mounted in a location where pipe that is positively pressurized by the fan is located inside of conditioned or occupiable space.

R324.36 System monitor required. Each *ASD* system shall be provided with a system negative pressure monitor, such as, but not limited to, manometer type pressure gauges, to indicate system operation. The system monitor shall be located indoors in an area where the monitor is readily observable by the occupants.

R324.37 Startup marking. *ASD* system monitors shall be clearly marked to indicate the pressure that existed when the system was initially activated. The monitor device shall have a durable label on or in close proximity to it that describes how to interpret the monitor and what to do if the monitor indicates that system performance has degraded.

R324.38 Automatic reset. Pressure activated electrical *ASD* system monitors, whether visual or audible, shall be supplied by un-switched electrical branch circuits and shall be designed to reset automatically when power is restored after power supply failure. Battery operated monitoring devices shall not be used except where they are equipped with a low power warning feature.

R324.39 Labels required (system and sump). System description labels made of durable material shall be placed on or within 12 inches [30 cm] of the electric service panel and also on the *ASD* system or other prominent location. The lettering on the label shall be not less than 1/4 inch [6.35 mm] in height and shall be of a color in contrast to the color of the background on which the lettering is applied. The label shall state the following: "Radon Reduction System;" the installer's name, phone number, and applicable certification identification; date of installation, an advisory stating that the building should be tested for *radon* at least every 2 years or as required or recommended by state or federal agencies. and shall include notice of additional *radon* resources at www.epa.gov/radon and the *radon* hotline 1-800-SOS-RADON (767-7236).

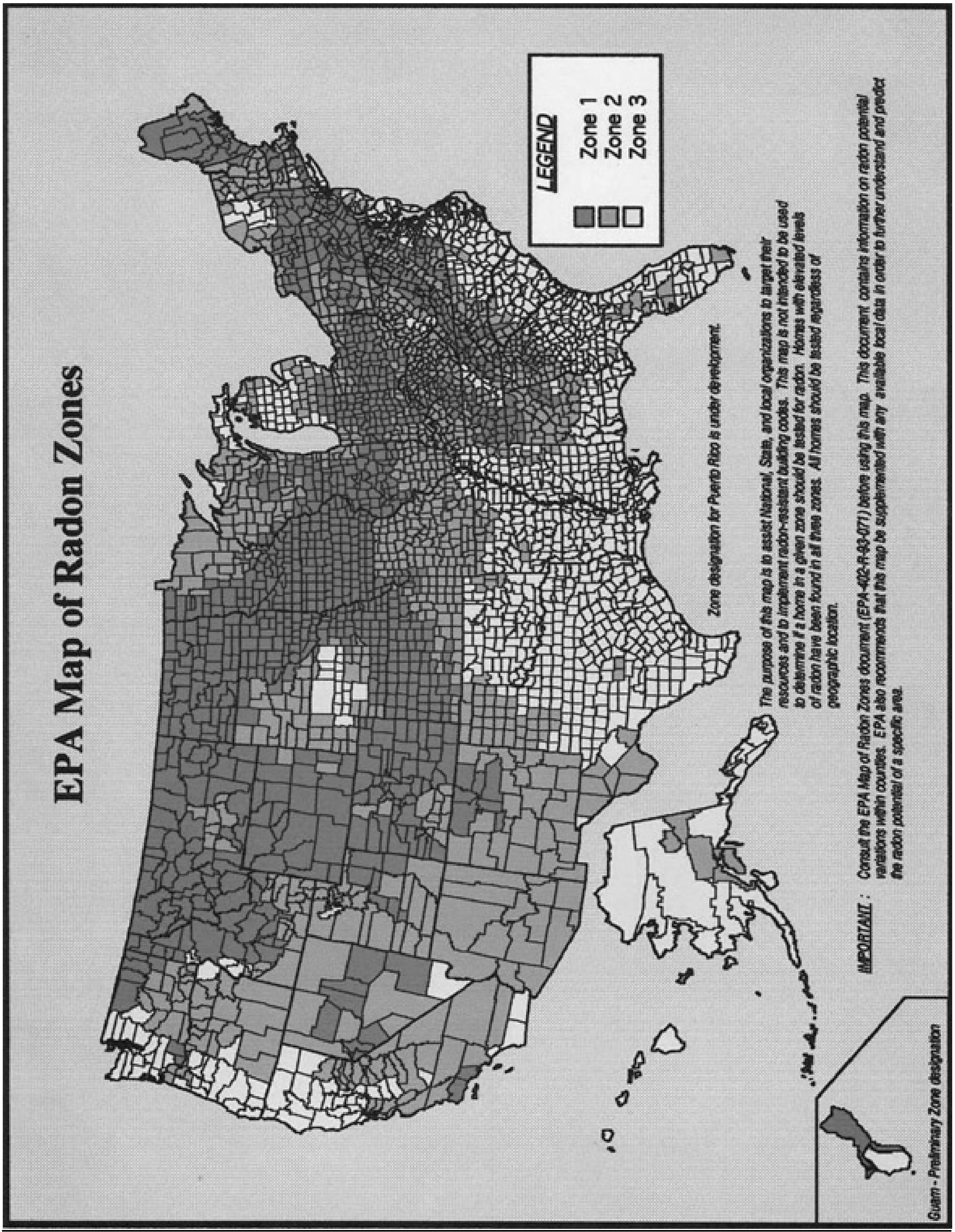
R324.39.1 Label sump basins. Sump basin covers shall be identified with a durable label that reads as follows: "Component of a Radon Reduction System. Do not tamper with or disconnect." or approved equivalent wording. The lettering on the label shall be not less than 1/4 inch [6.35 mm] in height and shall be of a color in contrast to the color of the background on which the lettering is applied.

R324.40 Documentation package. The occupants of the *dwelling* shall be provided with a documentation package that includes the following:

1. A description of system operation, such as shown in Exhibit 1 "Understanding a Radon Reduction System".
2. All *radon* test data for the property.
3. The annual energy consumption of the installed *ASD fan*(s), whether estimated or actual, and the projected monetary cost of such energy.

R324.41 Radon testing prior to occupancy. A *radon* test shall be performed prior to occupancy and shall be performed by a *certified* or *licensed* measurement professional. Testing shall be performed in accordance with applicable state protocols or requirements; or if there are no state protocols or requirements, with accepted Federal protocols or "Protocols for Radon Measurements in Homes", AARST Consortium on National Radon Standards. Where testing results are greater than the *NAL*, a *certified* and/or *licensed mitigator* shall be required to perform *diagnostic tests* and remediation action. Further *radon* testing shall be required until *radon* concentrations below the *NAL* are achieved.

R324.42 EPA established zones. The *radon* potential of a building site shall be estimated from Figure R324.42 or from Table R324.42. Where state or local jurisdictions have published *radon* potential data, such data shall supersede the information in Figure R324.42 and Table R324.42.



<u>FIGURE R324.42</u>
<u>RADON POTENTIAL ZONES MAP</u>
<u>TABLE R324.42 EPA RADON ZONE 1 and 2 COUNTIES BY STATE</u>

Alabama

Zone 1
Calhoun
Clay
Cleburne
Colbert
Coosa
Franklin
Jackson
Lauderdale
Lawrence
Limestone
Madison
Morgan
Talladega

Zone 2
Autauga
Barbour
Bibb
Blount
Bullock
Cherokee
Chilton
Cullman
Dallas
DeKalb
Elmore
Etowah
Fayette
Greene
Hale
Jefferson
Lamar
Lee
Lowndes
Macon
Marion
Marshall
Montgomery
Perry
Pickens
Randolph
Russell
Shelby
St Clair
Sumter
Tuscaloosa
Walker
Winston

Alaska

Zone 2
Anchorage
Municipality
Dillingham
Census Area
Fairbanks
North Star
Borough
Kenai
Peninsula
Borough
Matanuska-
Susitna
Borough
Southeast
Fairbanks
Census Area

Arizona

Zone 2
Apache
Cochise
Coconino
Gila
Graham
Greenlee
La Paz
Maricopa
Mohave
Navajo
Pima
Pinal
Santa Cruz
Yavapai
Yuma

Arkansas

Zone 2
Baxter
Benton
Boone
Carroll
Fulton
Garland
Independenc
e
Izard
Marion
Montgomery
Randolph
Searcy
Sharp
Stone

California

Zone 1
Santa
Barbara
Ventura

Zone 2
Alameda
Alpine
Amador
Calaveras
Contra
Costa
El Dorado
Fresno
Inyo
Kern
Los Angeles
Madera
Mariposa
Mono
Monterey
Nevada
Placer
Plumas
Riverside
San Benito
San
Bernardino
San
Francisco
San Luis
Obispo
San Mateo
Santa Clara
Santa Cruz
Sierra
Tulare
Tuolumne
Yuba

Colorado

Zone 1
Adams
Arapahoe
Baca
Bent
Boulder
Broomfield
Chaffee
Cheyenne
Clear Creek
Crowley
Custer
Delta
Denver
Dolores
Douglas
El Paso
Elbert
Fremont
Garfield
Gilpin
Grand
Gunnison
Huerfano
Jackson
Jefferson
Kiowa
Kit Carson
La Plata
Larimer
Las Animas
Lincoln
Logan
Mesa
Moffat
Montezuma
Montrose
Morgan
Otero
Ouray
Park
Phillips
Pitkin
Prowers
Pueblo
Rio Blanco
San Miguel
Sedgwick
Summit
Teller
Washington
Weld
Yuma

Zone 2
Alamosa
Archuleta
Conejos
Costilla
Eagle
Hinsdale
Lake
Mineral
Rio Grande
Routt
Saguache
San Juan

Connecticut

Zone 1
Fairfield
Middlesex
New Haven
New London
Zone 2
Litchfield
Tolland
Windham

Delaware

Zone 2
New Castle

Florida

Zone 2
Alachua
Citrus
Columbia
Hillsborough
Leon
Marion
Miami-Dade
Polk
Union

Georgia

Zone 1
Cobb
DeKalb
Fulton
Gwinnett

Zone 2
Banks
Barrow
Bartow
Butts
Carroll
Catoosa
Cherokee
Clarke
Clayton
Coweta
Dawson
Douglas
Elbert
Fannin
Fayette
Floyd
Forsyth
Franklin
Gilmer
Greene
Habersham
Hall
Haralson
Harris
Hart
Heard
Henry
Jackson
Jasper
Lamar
Lumpkin
Madison
Meriwether
Monroe
Morgan
Newton
Oconee
Oglethorpe
Paulding
Pickens
Pike
Rabun
Richmond
Rockdale
Spalding
Stephens
Talbot
Towns
Troup
Union
Upson
Walker
Walton
White
Whitfield

Hawaii

------None----
-

Idaho

Zone 1
Benewah
Blaine
Boise
Bonner
Boundary

Butte
Camas
Clark
Clearwater
Custer
Elmore
Fremont
Gooding
Idaho
Kootenai
Latah
Lemhi
Shoshone
Valley

Zone 2
Ada
Bannock
Bear Lake
Bingham
Bonneville
Canyon
Caribou
Cassia
Franklin
Jefferson
Jerome
Lincoln
Madison
Minidoka
Oneida
Owyhee
Payette
Power
Teton
Twin Falls

Illinois

Zone 1
Adams
Boone
Brown
Bureau
Calhoun
Carroll
Cass
Champaign
Coles
De Witt
DeKalb
Douglas
Edgar
Ford
Fulton
Greene
Grundy
Hancock
Henderson
Henry
Iroquois
Jersey
Jo Daviess
Kane
Kendall
Knox
LaSalle
Lee
Livingston
Logan
Macon
Marshall
Mason
McDonough
McLean
Menard
Mercer
Morgan
Moultrie
Ogle
Peoria
Piatt
Pike
Putnam
Rock Island
Sangamon
Schuyler
Scott
Stark
Stephenson
Tazewell
Vermilion
Warren
Whiteside
Winnebago
Woodford

Zone 2
Bond
Christian
Clark
Clay
Clinton
Cook
Crawford
Cumberland
DuPage
Edwards
Effingham
Fayette
Franklin
Gallatin
Hamilton
Hardin
Jackson
Jasper
Jefferson
Johnson
Kankakee
Lake
Lawrence
Macoupin
Madison
Marion
McHenry
Monroe
Montgomery
Perry
Pope
Randolph
Richland
Saline
Shelby
St Clair
Union
Wabash
Washington
Wayne
White
Will
Williamson

Indiana

Zone 1
Adams
Allen
Bartholomew
Benton
Blackford
Boone
Carroll
Cass
Clark
Clinton
Decatur
DeKalb
Delaware
Elkhart
Fayette
Fountain
Fulton
Grant
Hamilton
Hancock
Harrison
Hendricks
Henry
Howard
Huntington
Jay
Jennings
Johnson
Kosciusko
LaGrange
Lawrence
Madison
Marion
Marshall
Miami
Monroe
Montgomery
Noble
Orange
Putnam
Randolph
Rush
Scott
Shelby
St Joseph
Steuben
Tippecanoe
Tipton
Union
Vermillion
Wabash
Warren
Washington
Wayne
Wells
White
Whitley

Zone 2
Brown
Clay
Crawford
Daviess
Dearborn
Dubois
Floyd
Franklin
Gibson
Greene
Jackson
Jasper
Jefferson
Knox
Lake
LaPorte
Martin
Morgan
Newton
Ohio
Owen
Parke
Perry
Pike
Porter
Posey
Pulaski
Ripley
Spencer
Starke
Sullivan
Switzerland
Vanderburgh
Vigo
Warrick

Iowa

Zone 1
Adair
Adams
Allamakee
Appanoose
Audubon
Benton
Black Hawk
Boone
Bremer
Buchanan
Buena Vista
Butler
Calhoun
Carroll
Cass
Cedar
Cerro Gordo
Cherokee
Chickasaw
Clarke
Clay
Clayton
Clinton
Crawford
Dallas
Davis
Decatur
Delaware
Des Moines
Dickinson
Dubuque
Emmet
Fayette
Floyd
Franklin
Fremont
Greene
Grundy
Guthrie
Hamilton
Hancock
Hardin
Harrison
Henry
Howard
Humboldt
Ida
Iowa
Jackson
Jasper
Jefferson
Johnson
Jones
Keokuk
Kossuth
Lee
Linn
Louisa
Lucas
Lyon
Madison
Mahaska
Marion
Marshall
Mills
Mitchell
Monona
Monroe
Montgomery
Muscatine
O'Brien
Osceola
Page
Palo Alto
Plymouth
Pocahontas
Polk
Pottawattami
e
Poweshiek
Ringgold
Sac
Scott
Shelby
Sioux
Story
Tama
Taylor
Union
Van Buren
Wapello
Warren
Washington

Wayne
Webster
Winnebago
Winneshiek
Woodbury
Worth
Wright

Kansas

Zone 1
Atchison
Barton
Brown
Cheyenne
Clay
Cloud
Decatur
Dickinson
Douglas
Ellis
Ellsworth
Finney
Ford
Geary
Gove
Graham
Grant
Gray
Greeley
Hamilton
Haskell
Hodgeman
Jackson
Jewell
Johnson
Kearny
Kingman
Kiowa
Lane
Leavenworth
Lincoln
Logan
Marion
Marshall
McPherson
Meade
Mitchell
Nemaha
Ness
Norton
Osborne
Ottawa
Pawnee
Phillips
Pottawatomie
Pratt
Rawlins
Republic
Rice
Riley
Rooks
Rush
Russell
Saline
Scott
Sheridan
Sherman
Smith
Stanton
Thomas
Trego
Wallace
Washington
Wichita
Wyandotte

Zone 2
Allen
Anderson
Barber
Bourbon
Butler
Chase
Chautauqua
Cherokee
Clark
Coffey
Comanche
Cowley
Crawford
Doniphan
Edwards
Elk
Franklin
Greenwood
Harper
Harvey
Jefferson
Labette
Linn
Lyon
Miami
Montgomery
Morris
Morton
Neosho
Osage
Reno
Sedgwick
Seward
Shawnee
Stafford
Stevens
Sumner
Wabaunsee
Wilson
Woodson

Kentucky

Zone 1
Adair
Allen
Barren
Bourbon
Boyle
Bullitt
Casey
Clark
Cumberland
Fayette
Franklin
Green
Harrison
Hart
Jefferson
Jessamine
Lincoln
Marion
Mercer
Metcalfe
Monroe
Nelson
Pendleton
Pulaski
Robertson
Russell
Scott
Taylor
Warren
Woodford

Zone 2
Anderson
Bath
Bell
Boone
Boyd
Bracken
Breathitt
Breckinridge
Butler
Caldwell
Campbell
Carroll
Carter
Christian
Clay
Clinton
Crittenden
Daviess
Edmonson
Elliott
Estill
Fleming
Floyd
Gallatin
Garrard
Grant
Grayson
Greenup
Hancock
Hardin
Harlan
Henderson
Henry
Hopkins
Jackson
Johnson
Kenton
Knott
Knox
Larue
Laurel
Lawrence
Lee
Leslie
Letcher
Lewis
Livingston
Logan
Lyon
Madison
Magoffin
Martin
Mason
McCreary
McLean
Meade
Menifee
Montgomery
Morgan
Muhlenberg
Nicholas
Ohio
Oldham
Owen
Owsley
Perry
Pike
Powell
Rockcastle
Rowan
Shelby
Simpson
Spencer
Todd
Trigg
Trimble
Union
Washington
Wayne
Webster
Whitley
Wolfe

Louisiana

-------None------

Maine

Zone 1
Androscoggin
Aroostook
Cumberland
Franklin
Hancock
Kennebec
Lincoln
Oxford
Penobscot
Piscataquis
Somerset
York

Zone 2
Knox
Sagadahoc
Waldo
Washington

Maryland

Zone 1
Baltimore
Calvert
Carroll
Frederick
Harford
Howard
Montgomery
Washington

Zone 2
Allegany
Anne Arundel
Baltimore City
Cecil
Charles
Garrett
Prince George's
Somerset

Massachusetts

Zone 1
Essex
Middlesex
Worcester

Zone 2
Barnstable
Berkshire
Bristol
Dukes
Franklin
Hampden
Hampshire
Nantucket
Norfolk
Plymouth

Michigan

Zone 1
Branch
Calhoun
Cass
Hillsdale
Jackson
Kalamazoo
Lenawee
St Joseph
Washtenaw

Zone 2
Alcona
Alger
Alpena
Antrim
Baraga
Barry

Charlevoix
Clinton
Dickinson
Eaton
Emmet
Genesee
Gogebic
Houghton
Ingham
Ionia
Iron
Kent
Keweenaw
Lapeer
Leelanau
Livingston
Marquette
Menominee
Monroe
Montcalm
Montmorenc
y
Oakland
Otsego
Presque Isle
Sanilac
Shiawassee

Minnesota

Zone 1
Becker
Big Stone
Blue Earth
Brown
Carver
Chippewa
Clay
Cottonwood
Dakota
Dodge
Douglas
Faribault
Count
Fillmore
Freeborn
Goodhue
Grant
Hennepin
Houston
Hubbard
Jackson
Kanabec
Kandiyohi
Kittson
Lac qui Parle
Le Sueur
Lincoln
Lyon
Mahnomen
Marshall
Martin
McLeod
Meeker
Mower
Murray
Nicollet
Nobles
Norman
Olmsted
Otter Tail
Pennington
Pipestone
Polk
Pope
Ramsey
Red Lake
Redwood
Renville
Rice
Rock
Roseau
Scott
Sherburne
Sibley
Stearns
Steele
Stevens
Swift
Todd
Traverse
Wabasha
Wadena
Waseca
Washington
Watonwan
Wilkin
Winona
Wright
Yellow
Medicine

Zone 2
Aitkin
Anoka
Beltrami
Benton
Carlton
Cass
Chisago
Clearwater
Cook
Crow Wing
Isanti
Itasca
Koochiching
Lake
Lake of the
Woods
Mille Lacs
Morrison
Pine
St Louis

Mississippi

Zone 2
Alcorn
Chickasaw
Clay
Lee
Lowndes
Noxubee
Pontotoc
Rankin
Union
Washington

Missouri

Zone 1
Andrew
Atchison
Buchanan
Cass
Clay
Clinton
Holt
Iron
Jackson
Nodaway
Platte

Zone 2
Adair
Audrain
Barry
Barton
Bates
Benton
Bollinger
Boone
Caldwell
Callaway
Camden
Cape
Girardeau
Carroll
Carter
Cedar
Chariton
Christian
Clark
Cole
Cooper
Crawford
Dade
Dallas
Daviess
DeKalb
Dent
Douglas
Franklin
Gasconade
Gentry
Greene
Grundy
Harrison
Henry
Hickory
Howard
Howell
Jasper
Jefferson
Johnson
Knox
Laclede
Lafayette
Lawrence
Lewis
Lincoln
Linn
Livingston
Macon
Madison
Maries
Marion
McDonald
Mercer
Miller
Moniteau
Monroe
Montgomery
Morgan
Newton
Oregon
Osage
Ozark
Perry
Pettis
Phelps
Pike
Polk
Pulaski
Putnam
Ralls
Randolph
Ray
Reynolds
Ripley
Saline
Schuyler
Scotland
Shannon
Shelby
St Charles
St Clair
St Francois
St Louis city
St Louis
Ste
Genevieve
Stone
Sullivan
Taney
Texas
Vernon
Warren
Washington
Wayne
Webster
Worth
Wright

Montana

Zone 1
Beaverhead
Big Horn
Blaine
Broadwater
Carbon
Carter
Cascade
Chouteau
Custer
Daniels
Dawson
Deer Lodge
Fallon
Fergus
Flathead
Gallatin
Garfield
Glacier
Granite
Hill
Jefferson
Judith Basin
Lake
Lewis and
Clark
Liberty
Lincoln
Madison
McCone
Meagher
Mineral
Missoula
Park
Phillips
Pondera
Powder
River
Powell
Prairie
Ravalli
Richland
Roosevelt
Rosebud
Sanders
Sheridan
Silver Bow
Stillwater
Teton
Toole
Valley
Wibaux

Zone 2
Golden
Valley
Musselshell
Petroleum
Sweet Grass
Treasure
Wheatland
Yellowstone

Nebraska

Zone 1
Adams
Boone
Boyd
Burt
Butler
Cass
Cedar
Clay
Colfax
Cuming
Dakota
Dixon

Dodge
Douglas
Fillmore
Franklin
Frontier
Furnas
Gage
Gosper
Greeley
Hamilton
Harlan
Hayes
Hitchcock
Jefferson
Johnson
Kearney
Knox
Lancaster
Madison
Nance
Nemaha
Nuckolls
Otoe
Pawnee
Phelps
Pierce
Platte
Polk
Red Willow
Richardson
Saline
Sarpy
Saunders
Seward
Stanton
Thayer
Thurston
Washington
Wayne
Webster
York

Zone 2

Antelope
Banner
Box Butte
Buffalo
Chase
Cheyenne
Custer
Dawes
Dawson
Deuel
Dundy
Hall
Howard
Keith
Keya Paha
Kimball
Merrick
Morrill
Perkins
Scotts Bluff
Sheridan
Sherman
Sioux
Valley

Nevada

Zone 1

Carson City
Douglas
Eureka
Lander
Lincoln
Lyon
Mineral
Pershing
White Pine

Zone 2

Churchill
Elko
Esmeralda
Humboldt
Nye
Storey
Washoe

New Hampshire

Zone 1

Carroll

Zone 2

Belknap
Cheshire
Coos
Grafton
Hillsborough
Merrimack
Rockingham
Strafford
Sullivan

New Jersey

Zone 1

Hunterdon
Mercer
Monmouth
Morris
Somerset
Sussex
Warren

Zone 2

Bergen
Burlington
Camden
Cumberland
Essex
Gloucester
Hudson
Middlesex
Passaic
Salem
Union

New Mexico

Zone 1

Bernalillo
Colfax
Mora
Rio Arriba
San Miguel
Santa Fe
Taos

Zone 2

Catron
Chaves
Cibola
Curry
De Baca
Dona Ana
Eddy
Grant
Guadalupe
Harding
Hidalgo
Lea
Lincoln
Los Alamos
Luna
McKinley
Otero
Quay
Roosevelt
San Juan
Sandoval
Sierra
Socorro
Torrance
Union
Valencia

New York

Zone 1

Albany
Allegany
Broome
Cattaraugus
Cayuga
Chautauqua
Chemung
Chenango
Columbia
Cortland
Delaware
Dutchess
Erie
Genesee
Greene
Livingston
Madison
Onondaga
Ontario
Orange
Otsego
Putnam
Rensselaer
Schoharie
Schuyler
Seneca
Steuben
Sullivan
Tioga
Tompkins
Ulster
Washington
Wyoming
Yates

Zone 2

Clinton
Jefferson
Lewis
Monroe
Montgomery
Niagara
Oneida
Orleans
Oswego
Saratoga
Schenectady
St Lawrence
Wayne

North Carolina

Zone 1

Alleghany
Buncombe
Cherokee
Henderson
Mitchell
Rockingham
Transylvania
Watauga

Zone 2

Alexander
Ashe
Avery
Burke
Caldwell
Caswell
Catawba
Clay
Cleveland
Forsyth
Franklin
Gaston
Graham
Haywood
Iredell
Jackson
Lincoln
Macon
Madison
McDowell
Polk
Rutherford
Stokes
Surry
Swain
Vance
Wake
Warren
Wilkes
Yadkin
Yancey

North Dakota

Zone 1

Adams
Barnes
Benson
Billings
Bottineau
Bowman
Burke
Burleigh
Cass
Cavalier
Dickey
Divide
Dunn
Eddy
Emmons
Foster
Golden
Valley
Grand Forks
Grant
Griggs
Hettinger
Kidder
LaMoure
Logan
McHenry
McIntosh
McKenzie
McLean
Mercer
Morton
Mountrail
Nelson
Oliver
Pembina
Pierce
Ramsey
Ransom
Renville
Richland
Rolette
Sargent
Sheridan
Sioux
Slope
Stark
Steele
Stutsman
Towner
Traill
Walsh
Ward
Wells
Williams

Ohio

Zone 1

Adams
Allen
Ashland
Auglaize

Belmont
Butler
Carroll
Champaign
Clark
Clinton
Columbiana
Coshocton
Crawford
Darke
Delaware
Fairfield
Fayette
Franklin
Greene
Guernsey
Hamilton
Hancock
Hardin
Harrison
Holmes
Huron
Jefferson
Knox
Licking
Logan
Madison
Marion
Mercer
Miami
Montgomery
Morrow
Muskingum
Perry
Pickaway
Pike
Preble
Richland
Ross
Seneca
Shelby
Stark
Summit
Tuscarawas
Union
Van Wert
Warren
Wayne
Wyandot

Zone 2
Ashtabula
Athens
Brown
Clermont
Cuyahoga
Defiance
Erie
Fulton
Gallia
Geauga
Henry
Highland
Hocking
Jackson
Lake
Lawrence
Lorain
Lucas
Mahoning
Medina
Meigs
Monroe
Morgan
Noble
Ottawa
Paulding
Portage
Putnam
Sandusky
Scioto
Trumbull
Vinton
Washington
Williams
Wood

Oklahoma

Zone 2
Adair
Beaver
Cherokee
Cimarron
Delaware
Ellis
Mayes
Sequoyah
Texas

Oregon

Zone 2
Baker
Clatsop
Columbia
Crook
Gilliam
Grant
Harney
Hood River
Jefferson
Klamath
Lake
Malheur
Morrow
Multnomah
Sherman
Umatilla
Union
Wasco
Washington
Wheeler
Yamhill

Pennsylvania

Zone 1
Adams
Allegheny
Armstrong
Beaver
Bedford
Berks
Blair
Bradford
Bucks
Butler
Cameron
Carbon
Centre
Chester
Clarion
Clearfield
Clinton
Columbia
Cumberland
Dauphin
Delaware
Franklin
Fulton
Huntingdon
Indiana
Juniata
Lackawanna
Lancaster
Lebanon
Lehigh
Luzerne
Lycoming
Mifflin
Monroe
Montgomery
Montour
Northampton
Northumberland
Perry
Schuylkill
Snyder
Sullivan
Susquehanna
Tioga
Union
Venango
Westmoreland
Wyoming
York

Zone 2
Cambria
Crawford
Elk
Erie
Fayette
Forest
Greene
Jefferson
Lawrence
McKean
Mercer
Pike
Potter
Somerset
Warren
Washington
Wayne

Rhode Island

Zone 1
Kent
Washington

Zone 2
Newport
Providence

South Carolina

Zone 1
Greenville

Zone 2
Abbeville
Anderson
Cherokee
Laurens
Oconee
Pickens
Spartanburg
York

South Dakota

Zone 1
Aurora
Beadle
Bon Homme
Brookings
Brown
Brule
Buffalo
Campbell
Charles Mix
Clark
Clay
Codington
Corson
Davison
Day
Deuel
Douglas
Edmunds
Faulk
Grant
Hamlin
Hand
Hanson
Hughes
Hutchinson
Hyde
Jerauld
Kingsbury
Lake
Lincoln
Lyman
Marshall
McCook
McPherson
Miner
Minnehaha
Moody
Perkins
Potter
Roberts
Sanborn
Spink
Stanley
Sully
Turner
Union
Walworth
Yankton

Zone 2
Bennett
Butte
Custer
Dewey
Fall River
Gregory
Haakon
Harding
Jackson
Jones
Lawrence
Meade
Mellette
Pennington
Shannon
Todd
Tripp
Ziebach

Tennessee

Zone 1
Anderson
Bedford
Blount
Bradley
Claiborne
Davidson
Giles
Grainger
Greene
Hamblen
Hancock
Hawkins
Hickman
Humphreys
Jackson
Jefferson
Knox
Lawrence
Lewis
Lincoln
Loudon
Macon
Madison
Marshall
McMinn
Meigs
Monroe
Moore
Perry

Roane
Rutherford
Smith
Sullivan
Trousdale
Union
Washington
Wayne
Williamson
Wilson

Zone 2
Benton
Cannon
Carter
Cheatham
Chester
Clay
Cocke
Coffee
Decatur
DeKalb
Dickson
Fentress
Hamilton
Hardin
Henderson
Houston
Johnson
Marion
McNairy
Montgomery
Overton
Pickett
Polk
Putnam
Robertson
Sevier
Stewart
Sumner
Unicoi
Van Buren
Warren
White

Texas

Zone 2
Armstrong
Bailey
Brewster
Carson
Castro
Crosby
Culberson
Dallam
Deaf Smith
Donley
Floyd
Garza
Gray
Hale
Hansford
Hartley
Hemphill
Hockley
Hudspeth
Hutchinson
Jeff Davis
Lamb
Lipscomb
Llano
Lubbock
Lynn
Mason
Moore
Ochiltree
Oldham
Parmer
Potter
Presidio
Randall
Reeves
Roberts
Sherman
Swisher
Terrell

Utah

Zone 1
Carbon
Duchesne
Grand
Piute
Sanpete
Sevier
Uintah

Zone 2
Beaver
Box Elder
Cache
Daggett
Davis
Emery
Garfield
Iron
Juab
Kane
Millard
Morgan
Rich
Salt Lake
San Juan
Summit
Tooele
Utah
Wasatch
Washington
Wayne
Weber

Vermont

Zone 2
Addison
Bennington
Caledonia
Essex
Franklin
Lamoille
Orange
Orleans
Rutland
Washington
Windham
Windsor

Virginia

Zone 1
Alleghany
Amelia
Appomattox
Augusta
Bath
Bland
Botetourt
Brunswick
Buckingham
Campbell
Chesterfield
Clarke
Craig
Cumberland
Dinwiddie
Fairfax
Fluvanna
Frederick
Giles
Goochland
Henry
Highland
Lee
Louisa
Montgomery
Nottoway
Orange
Page
Patrick
Pittsylvania
Powhatan
Pulaski
Roanoke
Rockbridge
Rockingham
Russell
Scott
Shenandoah
Smyth
Spotsylvania
Stafford
Tazewell
Warren
Washington
Wythe

Zone 2
Albemarle
Amherst
Arlington
Bedford
Buchanan
Carroll
Charlotte
Culpeper
Dickenson
Fauquier
Floyd
Franklin
Grayson
Greene
Halifax
Loudoun
Lunenburg
Madison
Mecklenburg
Nelson
Prince
Edward
Prince
William
Rappahanno
ck
Wise

Washington

Zone 1
Clark
Ferry
Okanogan
Pend Oreille
Skamania
Spokane
Stevens

Zone 2
Adams
Asotin
Benton
Columbia
Douglas
Franklin
Garfield
Grant
Kittitas
Klickitat
Lincoln
Walla Walla
Whitman
Yakima

West Virginia

Zone 1
Berkeley
Brooke
Grant
Greenbrier
Hampshire
Hancock
Hardy
Jefferson
Marshall
Mercer
Mineral
Monongalia
Monroe
Morgan
Ohio
Pendleton
Pocahontas
Preston
Summers
Wetzel

Zone 2
Barbour
Braxton
Cabell
Calhoun
Clay
Doddridge
Fayette
Gilmer
Harrison
Jackson
Lewis
Lincoln
Marion
Mason
Nicholas
Pleasants
Putnam
Raleigh
Randolph
Ritchie
Roane
Taylor
Tucker
Tyler
Upshur
Wayne
Webster
Wirt
Wood

Wisconsin

Zone 1
Buffalo
Crawford
Dane
Dodge
Door
Fond du Lac
Grant
Green
Green Lake
Iowa
Jefferson
Lafayette
Langlade
Marathon
Menominee
Pepin
Pierce
Portage
Richland
Rock
Shawano
St Croix
Vernon
Walworth
Washington
Waukesha
Waupaca
Wood

Zone 2
Adams
Ashland
Barron
Bayfield

Brown
Burnett
Calumet
Chippewa
Clark
Columbia
Douglas
Dunn
Eau Claire
Florence
Forest
Iron
Jackson
Juneau
Kenosha
Kewaunee
La Crosse
Lincoln
Manitowoc
Marinette
Marquette
Milwaukee
Monroe
Oconto
Oneida
Outagamie
Ozaukee
Polk
Price
Racine
Rusk
Sauk
Sawyer
Sheboygan
Taylor
Trempealea
u
Vilas
Washburn
Waushara
Winnebago

Wyoming

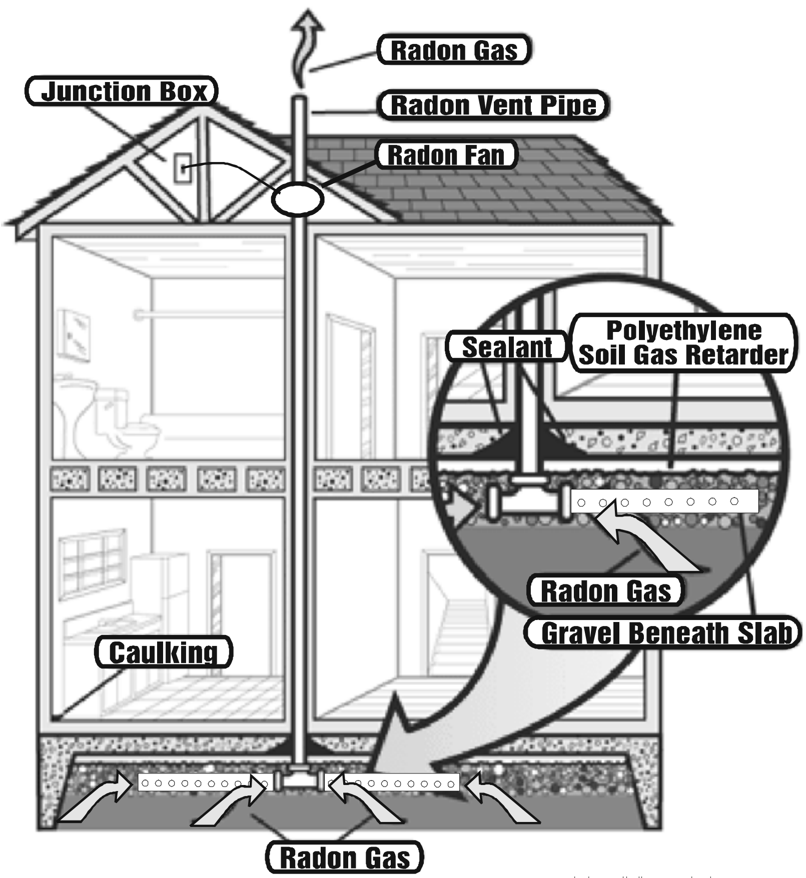
Zone 1
Albany
Big Horn
Campbell
Carbon
Converse
Crook
Fremont
Goshen
Hot Springs
Johnson
Laramie
Lincoln
Natrona
Niobrara
Park
Sheridan
Sublette
Sweetwater
Teton
Uinta
Washakie

Zone 2
Platte
Weston

R324.46
Exhibit 1 - Understanding a Radon Reduction System (Occupants)

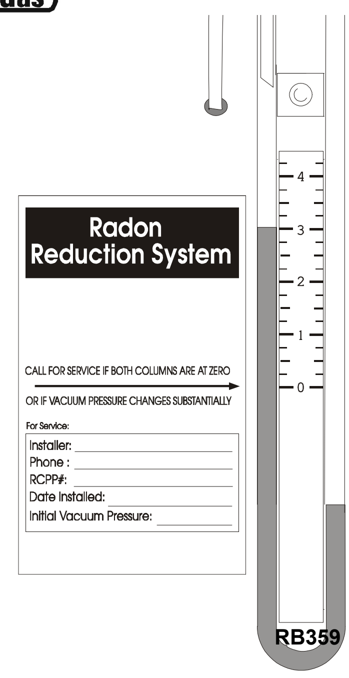
General: *Radon* is a radioactive gas that has been found in homes all over the United States. It comes from the natural breakdown of uranium in soil, rock and water and gets into the air you breathe. The *radon* potential of any specific building lot is dependent on whether there is sufficient *radon* source material in the ground below the home and sufficient upward air movement for the *radon* to be near your home's foundation. *Radon* typically moves up through the ground to the air above and into your home through gaps and other holes in the foundation. The primary health concern associated with *radon* is lung cancer. The Environmental Protection Agency (EPA) estimates that 21,000 people die in the US each year from *radon*-induced lung cancer.

Radon Reduction System: Your new home was constructed with an *Active Subslab Depressurization* (*ASD*) System to protect your family's health. The *ASD* system is designed to limit *radon* entry into your home by keeping the soil under your home at a lower pressure than the air in your home. In doing so, *radon* and other *soil gases* from below your home are exhausted above your roof through a specially designed *radon* fan. An *ASD* system is recognized by the EPA as the Best Available Technology for *radon* control because it keeps much of the *radon* from entering your home. The system is designed to run 24 hours a day, 7 days a week. The electrical power required to run the fan, which is the only active component in the system, will typically cost 5 to 25 cents per day depending upon the type of fan and your electrical utility rates. Cost to operate this fan would be less than operating a normal light bulb.



System Maintenance: Your *ASD* System is designed to provide many years of service under normal conditions without significant maintenance. As the occupant of this home, you need to routinely check the system pressure gauge or other system monitor to verify that the fan is operating correctly. There are various labeled components of your *radon* system such as pipe, crawlspace membrane, fan, system pressure monitor and sump basin. DO NOT ALTER OR DISCONNECT any of these components. If the sump basin is opened for required maintenance or repair, restore to the original condition immediately after completing work. You also need to be aware that foundation settling, renovations or additions to your home can change your indoor *radon* concentrations. A *certified/licensed radon mitigator* can provide guidance when changes are to be made to the *dwelling* or provide a routine check-up on the operation of the system.

Understanding the System Pressure Gauge: The pressure gauge shown on the right is typical of a gauge used to monitor the pressure developed in the piping system by the *radon* fan. Your fan pressure



should be checked regularly to ensure the fan system continues to operate properly. This gauge measures pressure in Inches Water Column (*in. WC*). This gauge does NOT measure *radon*.

Call for service if the measure changes substantially (20% or more) or if the gauge reads zero pressure (both columns equal).

Your *ASD* system may have an audible alarm to alert you to call for service in the event of a problem.

Radon Testing: Your builder left behind a long term test kit for you to use to test your home after you move in. The way you and your family live in your new home, how you set heating and cooling controls or use your clothes dryer and other exhaust fans can affect indoor *radon* levels. It is recommended that you test for a minimum of 3 months or preferably longer to determine your actual *radon* exposure in the home. Be sure to check the warranty your builder provides to make certain you complete your testing before the end of the new home warranty period.
Follow the instructions provided by the test laboratory to open, activate and place the test kit to test your *radon* levels.

The USEPA recommends that you retest your home at least every 2 years or if major renovations or additions are made to the *dwelling*.

Other sources of radon: *Radon* can also be found in the water from private wells. Testing can determine if your well contains significant amounts of *radon*.

More Info: For more information on *radon*, *radon* testing or *radon* removal: **www.epa.gov/radon**

NOTE: Exhibit 1 may be reprinted without license.

Add definitions as follows:

R202
DEFINITIONS

ACCESS (limited). For the purposes of Section R324, the point of entry to fan location that allows service personnel to reach an *ASD fan* or intended fan location for the purpose of installing or replacing an *ASD fan*. Such access does not require walkways, service platforms, level working spaces, receptacle and lighting outlets or clear and unobstructed passageways with continuous solid flooring such as are typically required for appliances that require periodic maintenance, servicing and inspection.

ACTIVE SOIL DEPRESSURIZATION (ASD). A family of *radon mitigation systems* involving fan-powered soil depressurization, including but not limited to *sub-slab depressurization* and *sub-membrane depressurization*.

ASD FAN. A particular type of fan that is designed and rated by the manufacturer for continuous duty and for use in an *ASD* system.

CERTIFIED. For the purposes of Section R324, a designation applied to individuals or companies that have met qualification requirements or are authorized by the state to provide *radon* laboratory, measurement or mitigation services. Programs providing national certifications for *radon* laboratories, measurement and mitigation professionals are those of the National Radon Proficiency Program (NRPP) and the National Radon Safety Board (NRSB). Also see LICENSED.

CHECK VALVE. A mechanical device that will allow water to flow in one direction while preventing airflow in the opposite direction.

DEPRESSURIZATION. A negative pressure induced in one area relative to another.

DIAGNOSTIC TESTS. For the purposes of Section R324, procedures, including Communication Tests and other tests, used to identify or characterize conditions under, beside and within buildings that could contribute to *radon* entry or elevated *radon* levels or that could provide information regarding the performance of a *radon mitigation system*.

GEOTEXTILE MATTING. A product suitable for soil contact, that provides a void space laterally through the material to allow air movement. The void space is created through a matrix of woven mesh, "egg crate" support of a fabric enclosure or similar means. Also referred to as "Vent Strip".

LICENSED. For the purposes of Section R324, a designation applied to individuals and/or companies that are qualified and specifically authorized as *radon* laboratories, measurement and/or mitigation professionals within certain states or jurisdictions that regulate *radon* services. Also see CERTIFIED.

MITIGATOR. For the purposes of Section R324, a *certified/licensed* individual who designs, installs or directly supervises the installation of the *radon ASD mitigation systems*.

MITIGATION SYSTEM. For the purposes of Section R324, any system or steps designed to reduce *radon* concentrations in the indoor air of a building.

NATIONAL RADON ACTION LEVEL (NRAL). The indoor *radon* concentration at which mitigation is recommended. The *NAL* is defined as the US Environmental Protection Agency's Action Level of 4 *pCi/L* [148 Bq/m^3].

PIPE LOOP. A continuous length of perforated pipe extending around the inside perimeter of the foundation.

RADON. A naturally occurring, chemically inert, radioactive element (Rn-222) which exists as a gas.

ROUGH-IN. For the purposes of Section R324, the installation of all parts and materials of an *ASD* system that must be completed prior to the placement of concrete, prior to the closure of building cavities and prior to the installation of finish materials. Such parts and materials are gas permeable layers, *soil gas retarders*, plenums, membranes, piping, *suction points*, discharge points and wiring.

SOIL GAS. The gas mixture present in soil, which could contain *radon* and water vapor.

SOIL GAS COLLECTION PLENUM. A constructed enclosure for collecting *radon* and other *soil gases* from under a foundation.

SOIL GAS COLLECTOR. A gas permeable conduit constructed of *gravel*, perforated pipe or *geotextile matting* for collecting *radon* and other *soil gases* from within a *soil gas collection plenum* and connecting the plenum to the *ASD* pipe system.

SOIL GAS RETARDER. A continuous membrane or other comparable material laid over a *soil gas* plenum or earthen floor area that is used to retard the flow of *soil gases* into a building.

SUB-MEMBRANE DEPRESSURIZATION. A *radon* mitigation technique designed to maintain lower air pressure in the space under a *soil gas retarder* membrane than above it by use of an *ASD fan* drawing air from beneath the membrane.

SUB-SLAB DEPRESSURIZATION. A *radon* mitigation technique designed to maintain lower air pressure under a floor slab than above it. An *ASD fan* is installed in the *radon* system piping that draws air from below the floor slab.

SUCTION POINT. For the purposes of Section R324, the location where the *soil gas collector* is connected to the *ASD* system piping.

Add standards to Chapter 44 as follows:

ASTM

D5926-11 “Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems “

E1745-11 “Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs”

Reason: 21,000 Americans die each year from radon-induced lung cancer. The primary source of exposure to radon for the general public is the home. Geographical areas of the highest radon potential in the United States are located in EPA radon zones 1 & 2. Application of the methods contained in this proposed code change will ensure all new homes built in radon zones 1 & 2 will be tested to be below the EPA Action Level of 4 pCi/L prior to occupancy.

The code change proposal presented herein was developed as an ANSI consensus standard by the AARST Radon Standards Consortium. This standard, AARST/ANSI #CCAH *“Reducing Radon in New Construction of 1 & 2 Family Dwellings and Townhouses,”* was produced by a committee of (27) representing radon professionals, home inspectors, home builders, architects, code officials, consumer advocates and state and federal government.

There is no requirement in the Residential Code to apply radon reduction methods to new construction and thereby prevent elevated radon concentrations in newly built homes. Appendix F of the IRC (Radon Control Methods) is inadequate, 20 years old and not a mandatory part of the building code unless voluntarily adopted by a local jurisdiction.

This proposal adds requirements to homes in the high risk radon counties. Like snow and wind load, seismic and flood-resistance provisions, this proposal targets requirements to the areas with the greatest likelihood of exposure. The EPA estimates that 1 out of 15 of all homes in the US has elevated indoor radon levels. The incidence of elevated radon may be greater than 7 out of 10 homes in some high radon areas. Nonrandomized industry data shows a significant number of homes across the United States have tested high for elevated indoor radon concentrations. Builders of new homes will continue to add to the existing inventory of homes with elevated radon without changes in the residential code that address this important life/safety issue.

Radon Test Results Data by State

STATE	STATENAME	TOTAL # TESTS	AVG (pCi/L)	% > EPA Action Level of 4 pCi/L
AL	ALABAMA	11,629	3.8	21.9
AK	ALASKA	432	2.2	13.0
AZ	ARIZONA	7,495	2.1	11.9
AR	ARKANSAS	1,243	2.5	13.7
CA	CALIFORNIA	16,960	2.1	9.1
CO	COLORADO	88,346	6.5	49.0
CT	CONNECTICUT	41,292	3.4	23.9
DE	DELAWARE	5,539	2.5	17.4
FL	FLORIDA	40,039	1.8	10.2
GA	GEORGIA	27,222	2.6	18.9
HI	HAWAII	94	0.4	2.1
ID	IDAHO	16,138	7.1	40.4
IL	ILLINOIS	84,366	5.1	41.0
IN	INDIANA	18,031	4.7	37.2
IA	IOWA	96,260	6.2	49.3
KS	KANSAS	34,288	5.2	44.0
KY	KENTUCKY	47,575	7.4	43.6
LA	LOUISIANA	786	0.9	3.1
ME	MAINE	5,494	5.9	38.3
MD	MARYLAND	55,949	5.4	33.4
MA	MASSACHUSETTS	29,850	3.8	25.6
MI	MICHIGAN	164,678	3.4	25.4
MN	MINNESOTA	135,419	4.7	42.2
MS	MISSISSIPPI	700	1.2	5.6
MO	MISSOURI	27,771	4.2	31.6
MT	MONTANA	18,082	7.2	46.3
NE	NEBRASKA	27,481	5.7	51.6
NV	NEVADA	1,952	3.0	19.3
NH	NEW HAMPSHIRE	35,974	5.5	34.0
NJ	NEW JERSEY	41,092	4.3	24.1
NM	NEW MEXICO	8,165	3.9	30.2
NY	NEW YORK	66,713	4.8	23.9
NC	NORTH CAROLINA	79,384	3.8	27.5
ND	NORTH DAKOTA	10,887	6.0	50.5

STATE	STATENAME	TOTAL # TESTS	AVG (pCi/L)	% > EPA Action Level of 4 pCi/L
OH	OHIO	102,352	7.9	49.0
OK	OKLAHOMA	1,356	2.3	9.7
OR	OREGON	13,675	3.5	25.4
PA	PENNSYLVANIA	149,543	8.3	44.3
RI	RHODE ISLAND	8,667	4.2	31.0
SC	SOUTH CAROLINA	38,971	2.7	18.7
SD	SOUTH DAKOTA	4,081	9.8	59.2
TN	TENNESSEE	40,632	4.6	31.8
TX	TEXAS	5,821	2.4	8.7
UT	UTAH	14,636	4.5	33.6
VT	VERMONT	3,231	3.7	23.4
VA	VIRGINIA	62,577	3.5	25.4
WA	WASHINGTON	22,199	7.0	39.3
DC	WASHINGTON DC	6,948	1.6	8.8
WV	WEST VIRGINIA	14,976	6.0	35.0
WI	WISCONSIN	72,694	5.6	41.8
WY	WYOMING	25,090	5.2	39.6
TOTALS		**1,834,775**		

Source: AARST radon industry test data; published 10/29/2012.

Cost Impact: This change proposal will slightly increase the cost of construction. Most homes can be built with only a mitigation system rough-in. If the home tests high for elevated radon then the system can be upgraded with a fan to reduce the indoor radon levels.

Cost of mitigation system rough-in (passive) =$296*

Cost of fan driven mitigation system = $707* (total cost, not in addition to $296)

Source: Annual Builder Practices Report 2011, NAHB Research Center, Inc.

The cost savings for reduced health care resulting from a healthier indoor environment has not been calculated.

Analysis: A review of the standards proposed for inclusion in the code, [ASTM D5926-11 and ASTM E1745-11] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB201-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R324 (NEW)-RB-KAPTUROWSKI

RB202 – 13
R324 (New)

Proponent: Tim Pate, City and County of Broomfield, CO, representing self

Add new text as follows:

SECTION R324
WINDOW REPLACEMENT

R324.1 Window replacement. Window replacements shall require permits and replacement windows shall comply with the requirements for new glazing including, but not limited to, emergency escape and rescue, child fall, safety glazing and energy related requirements.

Reason: This code change proposal will add specific language to require building permits for all replacement windows. The new windows will need to meet the current requirements for egress size requirements, child fall requirements, safety glazing requirements, and energy code requirements. It is important to require all new windows and glazing to meet the current code requirements in order to verify all of the current safety issues.

Based on surveys I have done throughout Colorado jurisdictions there is not a clear consensus on whether or not the current IRC does require permits for window changeouts.

I suggest that they are now required already based on language in section R101.2 which states that the scope of the IRC applies to "alterations" and section R105 which states permits are required for owner or authorized agent who intends to "alter" a structure. I also suggest this since window or glass replacement is not listed under exceptions to requiring a permit in section R105.2. This new language will clarify that a permit is required for this type of work and what requirements they need to comply with.

Cost Impact: This proposal will increase the cost of construction

RB202-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R324 (NEW)-RB-PATE

RB203 – 13
R202, R301.2.2.3.1, R324 (New)

Proponent: Maureen Traxler/City of Seattle/Washington Association of Building Officials Technical Code Development Committee (maureen.traxler@seattle.gov)

Revise as follows:

SECTION R202
DEFINITIONS

MEZZANINE~~, LOFT~~. An intermediate level or levels between the floor and ceiling of any *story* ~~with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located~~.

Revise as follows:

R301.2.2.3.1 Height limitations. Wood-framed buildings shall be limited to three stories above *grade* plane or the limits given in Table R602.10.3(3). Cold-formed, steel-framed buildings shall be limited to less than or equal to three stories above *grade* plane in accordance with AISI S230. Mezzanines as defined in Section R202 <u>that comply with Section R324</u> shall not be considered as stories. Structural insulated panel buildings shall be limited to two stories above *grade* plane.

<u>**SECTION R324**</u>
<u>**MEZZANINES**</u>

<u>**R324.1 General.** *Mezzanines* shall comply with Section R324.</u>

<u>**R324.2 Mezzanines.** The clear height above and below *mezzanine* floor construction shall be not less than 7 feet (2134 mm).</u>

<u>**R324.3 Area limitation.** The aggregate area of a *mezzanine or mezzanines* shall be not greater than one-third of the floor area of the room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the *mezzanine* is located.</u>

<u>**R324.4 Means of egress.** The *means of egress* for *mezzanines* shall comply with the applicable provisions of Section R311.</u>

<u>**R324.5 Openness.** *Mezzanines* shall be open and unobstructed to the room in which they *are* located except for walls not more than 42 inches (1067 mm) in height, columns and posts.</u>

<u>**Exceptions:**</u>

1. <u>*Mezzanines* or portions thereof are not required to be open to the room in which they are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the *mezzanine* area.</u>
2. <u>In buildings that are no more than two *stories* above *grade plane* and equipped throughout with an *automatic sprinkler system* in accordance with NFPA 13R, NFPA 13D or Appendix S, a *mezzanine* having two or more *means of egress* shall not be required to be open to the room in which the *mezzanine* is located.</u>

Reason: The IRC provisions for mezzanines are incomplete. The code provides a definition of “mezzanine, loft” but doesn’t include any other provisions to clarify the allowable size or extent of mezzanines. This proposal copies relevant portions of IBC Section 505.2 into the IRC.

Mezzanines are allowed to be considered not to be stories because they are limited in size and because they are subject to provisions that provide protection from fire hazards. Mezzanines are required to be open to the room in which they are located, which provides early warning to occupants should a fire occur in either the mezzanine or in the room. The IBC provisions also include more specific provisions for determining the portion of the room that can be included in the allowable area of the mezzanine.

There is also reason to limit the size of mezzanines. Section R301.2.2.3.1 states that mezzanines are not considered stories in the context of height limitations for buildings in higher seismic design categories. Mezzanines that are large in relation to the size of the story will act more like a story in response to seismic forces and should be treated as stories.

In addition, we are proposing to delete the word “loft” from the definition of mezzanine. The word is not used anywhere in the code, so it is not necessary to define it.

Cost Impact: The code change proposal will not increase the cost of construction.

RB203-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R324 (NEW)-RB-TRAXLER

RB204 – 13
R401.2 (NEW)

Proponent: Andrew Herseth, US Dept of Homeland Security, representing, Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Add new text as follows:

R401.2 Wind limitations. Where wind design is required in accordance with Section R301.2.1.1, foundations shall be designed in accordance with ICC 600 or the *International Building Code.*

Reason: This code change is essentially a clarification. Section R301.2.1.1 states that the wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2(4)B. However, the code does not clearly define the "wind provisions of this code". This new language simply clarifies the intent of the code. The footings and foundations specified in Chapter 4 of the IRC do not apply to buildings that are to be sited in high wind regions. ICC 600 contains prescriptive foundation details developed specifically for residential structures sited in high wind regions. Prescriptive details are provided for concrete, masonry and light-frame construction. Alternately, the foundation could be designed for the applicable wind loads using the IBC.

FEMA P-550, *Recommended Residential Construction for Coastal Areas* (FEMA, 2009), notes that - along with potential flood hazards, erosion and scour - high wind hazard must be considered in the design of residential building foundation for coastal areas. Appendix B of ICC 600 includes prescriptive flood-resistant foundation designs from FEMA P-550 that may be selected to support residential buildings in coastal high wind regions under specified conditions. Although most common in coastal areas, it is important to note that the damaging effects of hurricane-force winds are not limited to coastal counties.

Cost Impact: The code change proposal will not increase the cost of construction.

RB204-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R401.2 (NEW)-RB-HERSETH-OVERCASH.doc

RB205 – 13
R106.2.1 (NEW), R401.3, Chapter 44

Proponent: John Whitescarver, National Stormwater Center

Add new text as follows:

106.2.1 Stormwater pollution prevention. Where required by federal or state law, the construction documents shall include a stormwater construction permit and stormwater pollution prevention plan.

Revise as follows:

401.3 Drainage. Surface drainage shall be diverted to a stormwater sewer conveyance or other approved point of collection that does not create a hazard. Where required, surface drainage shall be accomplished in accordance with an approved pollution prevention plan complying with 40 CFR Part 450. *Lots* shall be graded to drain surface water away from foundation walls. The *grade* shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

> **Exception:** Where *lot lines*, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

Add new standard to Chapter 44 as follows:

EPA

40 CFR PART 450 Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category – December 1, 2009

Reason: At the national level, the construction and development industry is a major contributor to problems of water pollution, with consequent damage to the environment and infrastructure. These problems generated by the construction and development industry arise from failures to properly protect stormwater drains and conveyances from the impact of stormwater run-off during site preparation and then during construction activity.

Failure to control sedimentary and chemical run-off into the stormwater system has multiple impacts on local communities which reach far beyond the issue of water quality. Failure to adopt best management practices in this regard also leads to siltation of both the stormwater drainage system and the natural watercourses, thereby reducing capacity of those systems and directly increasing the risk of flooding.

The improper management of construction activities therefore constitutes a serious threat to flood-prone communities. This threat is also progressive in nature. Allowing cementatious materials to enter the stormwater drainage system leads to concretization of the deposited sediments. This constitutes a permanent capacity reduction in the stormwater system which is further reduced by each successive failure to protect the system during construction activity.

Attention to stormwater management practices is already a mandated issue under the IBC. Section 3301.1 of that code provides that "*Provision shall be made to control water run-off and erosion during construction or demolition activities*". However, this mandatory requirement is not supported by reference to the published regulatory performance standards imposed on local jurisdictions and construction contractors under the terms of the Act.

Further, the code does not make reference to required Stormwater Construction Permits or the mandated Stormwater Pollution Prevention Plans, within those sections defining and making reference to construction documents, except that the code provides "*where special conditions exist, the building official is authorized to require additional documents*". These stormwater documents clearly fall into the code defined category of "*construction documents*", but are not subject to specific citation in the code and not subject to code required submission to the building official to support application for a building permit. This results in such documents not being taken into account in plan review processes and denies the building inspector awareness of the contractors plans for compliance with construction law in this regard.

Under the code as currently drafted reliance must therefore be placed on the power of the building official to address "*special conditions*" by requiring the submission of additional construction documents. However claiming "*special conditions*" for a regular requirement is not necessarily the most prudent course in a litigious environment, opening the door to argument about the legitimacy of a building official's powers to require the submission of documents which should be required for a significant proportion of new construction activity.

These proposals for amendment of the IRC therefore seek to embed stormwater pollution prevention performance standards into the ICC codes, by reference to the appropriate legislation and regulatory standards mandated for enforcement by the local community. This action will not only address local, regional and national concerns with regard to water quality, but will also support other sections of the code related to reduction of flood hazard risk within local communities. For more information on stormwater go to www.npdes.com.

REFERENCE DOCUMENTS:

1. EPA Construction General Permit

Stormwater discharges from construction activities (such as clearing, grading, excavating, and stockpiling) that disturb one or more acres, or smaller sites that are part of a larger common plan of development or sale, are regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program. Prior to discharging stormwater, construction operators must obtain coverage under an NPDES permit, which is administered by either the State (if it has been authorized to operate the NPDES stormwater program) or EPA, depending on where the construction site is located.

On February 16, 2012, EPA issued a construction general permit at: http://www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf

2. Federal Register Volume 74, Number 229 (Tuesday, December 1, 2009)]

ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 450
Effluent Limitations Guidelines and Standards for the
Construction and Development Point Source Category
SUMMARY: The Environmental Protection Agency is publishing final regulations establishing Clean Water Act (CWA) technology-based Effluent Limitations Guidelines and New Source Performance Standards for the Construction and Development (C&D) point source category. EPA expects compliance with this regulation to reduce the amount of sediment and other pollutants discharged from construction and development sites by approximately 4 billion pounds per year.

The performance standards are found at:
http://www.gpo.gov/fdsys/pkg/FR-2009-12-01/html/E9-28446.htm

Cost Impact: The code change proposal will not increase the cost of construction. There is nothing in the proposal that represents new cost requirements. The requirements are in National Pollutant Elimination (NPDES) Permits issued under the Federal Clean Water Act.

Analysis: A review of the standard proposed for inclusion in the code, EPA 40 CFR450 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB205-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R401.3-RB-WHITESCARVER.doc

RB206 – 13
R401.5 (New)

Proponent: Jonathan Siu, City of Seattle Department of Planning & Development, representing Washington Association of Building Officials Technical Code Development Committee (jon.siu@seattle.gov)

Add new text as follows:

R401.5 Protection of adjoining property. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights, roofs and other building elements. Provisions shall be made to control water runoff and erosion during construction or demolition activities.

Reason: Currently, the IRC contains no provisions requiring adjacent property be protected from construction activities. This proposal brings text from IBC Section 3307 (Protection of Adjoining Property) into the IRC, bringing the codes into closer alignment. One difference between this proposal and the IBC text is the addition of "and other building elements" in the second sentence. The WABO TCD Committee feels it is just as important to protect elements such as bay or garden windows with roof-like components from hazards as it is to protect roofs and skylights.

It is to be noted that there is a requirement in the IBC text to notify owners of adjoining buildings at least 10 days prior to the start of excavation. The WABO TCD Committee considers this to be unenforceable language, and therefore has not included it in this proposal. However, if the committee feels led to do so, the following text (verbatim from IBC Section 3307.1) can be added to the proposal as a committee modification, in order to get complete consistency between the codes:

"The person making or causing an excavation to be made shall provide written notice to the *owners* of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation."

Cost Impact: Potential increase in initial cost of construction since this is not currently specifically regulated in the code, but may reduce potential for lawsuits where precautions are not already being taken.

RB206-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R401.5 (NEW) #1-RB-SIU.doc

RB207– 13
R401.5 (NEW), R403.1, Chapter 44

Proponent: Jonathan Siu, City of Seattle Department of Planning & Development, representing Washington Association of Building Officials Technical Code Development Committee (jon.siu@seattle.gov)

Revise as follows:

R401.5 Site work. Site work shall be performed in accordance with Sections R401.5.1 through R401.5.4.

R401.5.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Excavation, fill, or shoring, whether temporary or permanent, shall not extend onto adjacent property. Existing footings or foundations that can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement.

R401.5.2 Slope limits. Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the submittal of a geotechnical report acceptable to the *building official*.

R401.5.3 Surcharge. No fill or other surcharge loads shall be placed adjacent to any building or structure, or caused to be imposed on them, unless such building or structure is designed to resist the additional loads caused by the fill or surcharge.

R401.5.4 Soil supporting foundations. Footings and foundations shall be supported on undisturbed natural soils or engineered fill. Fill to be used to support the footings or foundations of any building or structure shall comply with the provisions of a geotechnical report acceptable to the *building official*. The compaction shall be verified by a *registered design professional*.

> **Exception:** Compacted fill material 12 inches (305 mm) in depth or less need not comply with a geotechnical report, provided the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557, and the compaction is verified by a *registered design professional*.

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems which shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. ~~Footings shall be supported on undisturbed natural soils or engineered fill.~~ Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

Add new standard to Chapter 44 as follows:

ASTM

D 1557-07 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lb/ft3 (2,700 KN m/m3)]

Reason: This proposal adds provisions to the IRC to protect adjacent structures and property from the effects of site work. Currently, there are no regulations in the IRC that would prevent an excavation for a foundation or footing from endangering adjacent buildings or property, nor is guidance given for fill material properties. An extreme example of where this was a problem was the collapse of the Lotus Riverside apartment building in Shanghai in 2009. There, the contractor stockpiled up to 10 meters of soil on one side of the building, while excavating on the other, leading to the building tipping over (see http://www.chinadaily.com.cn/china/2009-07/03/content_8376126.htm). For IRC-type buildings, the failures would not be as dramatic, but can still become a headache for the building official. This proposal is based on text found in IBC Section 3304, which would bring the two codes into closer alignment. Specifically:

R401.5.1 – Requires excavations or fill not endanger (undercut or overhang) adjacent buildings or property. It also clearly states that all site work (temporary or permanent) has to stay within the property lines—a principle that is understood by most people, but not stated anywhere in the I-codes. This does not preclude other approved alternates, such as a temporary easement, from being employed to allow work to extend onto the adjacent property, since those can be approved under Section R104.11. Finally, this section states that any footings or foundations that are undercut by an adjacent excavation must be underpinned or supported by other means. If the affected foundation is on the adjacent property, the shoring or permanent foundation wall being constructed must be designed for the appropriate surcharge to support the adjacent foundation. (See also proposed Section R401.5.3.)

R401.5.2 – Sets some practical limits on permanent cut or fill slopes. A geotechnical report (usually by a geotechnical engineer) can set different parameters, but the text gives the building official the opportunity to review the report to see if the recommendations are based on an appropriate investigation.

R401.5.3 – Requires structures supporting surcharge loads to be designed for those loads. Examples of sources of surcharge loads might be: a steep slope being supported by a retaining wall; vehicular loads from an adjacent right-of-way; foundation/footing loads from adjacent buildings; or fill placed next to an existing structure. All these and other sources can impose additional loads on foundation or retaining walls (or even temporary shoring walls) that must be accounted for in a design.

R401.5.4 – Replaces a general requirement in IRC Section 403.1, and gives more guidance. Requires structures be supported by natural soils or structural fill. Structural fill properties must be determined in a geotechnical report. Since special inspections are not included in the IRC but compaction must be verified, a registered design professional (again, usually a geotechnical engineer) is required to conduct the verification. The exception gives an alternative to the full geotechnical report, allowing field verification of 90% compaction in accordance with the ASTM standard if the compaction is again verified by a registered design professional.

Chapter 44 – The standard has already been adopted into the IBC, so the addition in Chapter 44 just brings it into the IRC in order to provide appropriate guidance for the purposes of the exception.

Cost Impact: The code change proposal will not increase the cost of construction, if site development is being done in accordance with IBC requirements as a matter of course, it may increase the cost of construction if not.

Analysis: A review of the standard proposed for inclusion in the code, ASTM D1557 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB207-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R401.5 (NEW) #2-RB-SIU.doc

RB208 – 13
R402.2.1 (New)

Proponent: Stephen S. Szoke, P.E., Portland Cement Association

Add new text as follows:

R402.2.1 Materials for concrete. Materials for concrete shall comply with the requirements of Section R611.5.1.

Reason: This change coordinates sections R402 and R611 to reflect updated standard specifications for Portland Cement, Blended Hydraulic Cement, and Hydraulic Cement referenced for use in concrete. This change directs the user to one section for specific information about the general properties and requirements for concrete.

Cost Impact: This change will not increase the cost of construction.

RB208-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R402.2.1 (NEW)-RB-SZOKE.doc

RB209 – 13
R402.4 (NEW)

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Add new text as follows:

<u>**R402.4 Masonry.** Masonry systems shall be designed and installed in accordance with this chapter and shall have a minimum specified compressive strength of 1,500 psi (10.3 MPa).</u>

Reason: Section R402 provides charging language for wood foundations (R402.1), concrete (R402.2), and precast concrete (R402.3), but not masonry. This is an inadvertent oversight that is corrected with this code change proposal. The addition of a minimum f'm of 1,500 psi reflects the design assumption upon which the prescriptive masonry foundation tables of Section R404.1.1.1 are based.

Cost Impact: This code change will not increase the cost of construction.

RB209-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R402.4 (NEW)-RB-THOMPSON.doc

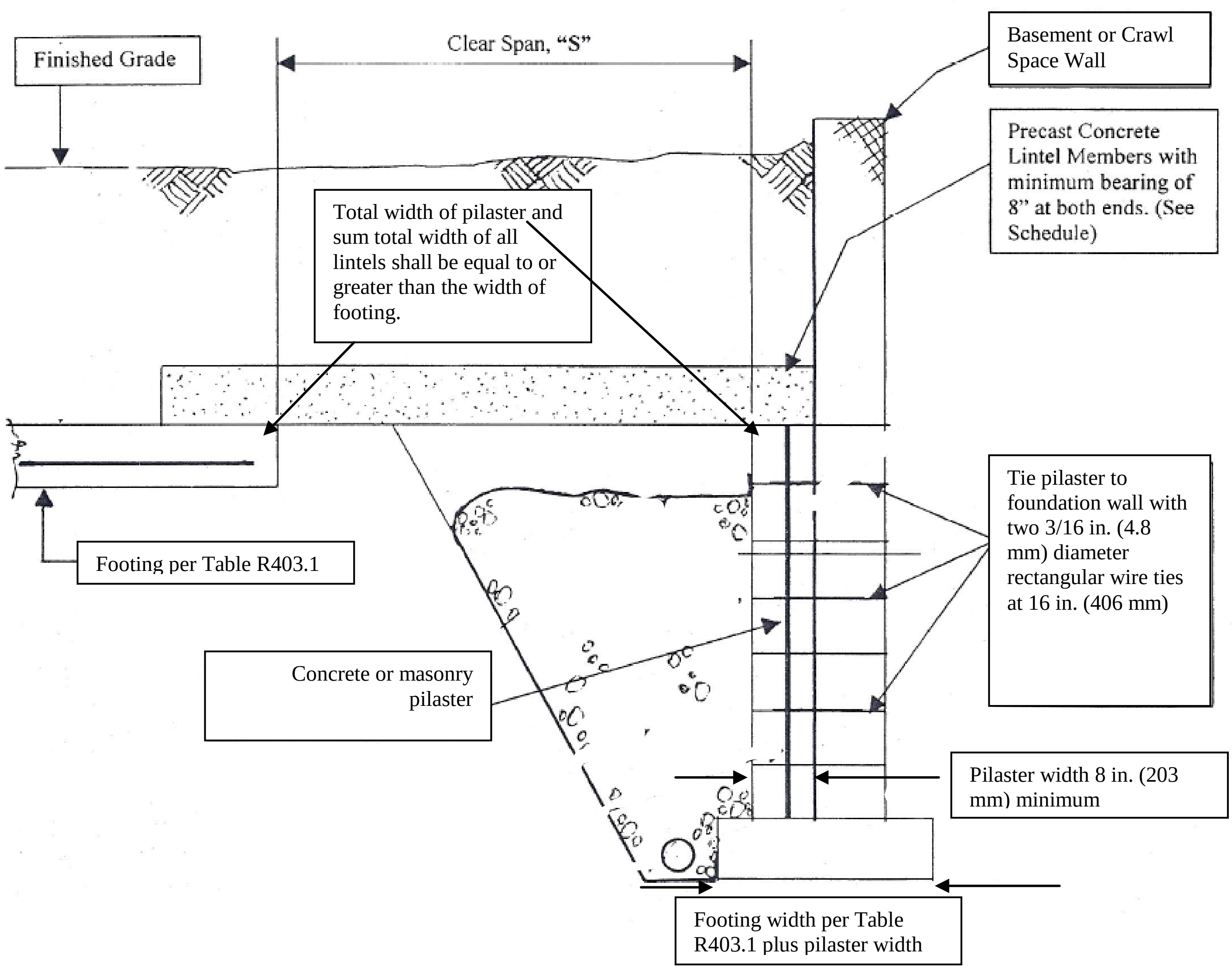
RB210 – 13
R403.1, Figure R403.3(1) (NEW)

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems which shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill. Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

<u>At transitions between footings located at different elevations, precast concrete lintels complying with Figure R403.1(1) shall be permitted in Seismic Design Categories A, B, and C.</u>



<u>**FIGURE 403.1(1) DISCONTINUOUS FOOTERS**</u>

<u>Required Reinforcement for Each 4 in. by 8 in. Lintel</u>			<u>Required Reinforcement for Each 6 in. by 8 in. Lintel</u>		
<u>Clear Span, S</u>	<u>Top Bar Size</u>	<u>Bottom Bar Size</u>	<u>Clear Span, S</u>	<u>Top Bar Size</u>	<u>Bottom Bar Size</u>
<u>4'-0"</u>	<u>No. 3</u>	<u>No. 3</u>	<u>4'-0"</u>	<u>No. 3</u>	<u>No. 3</u>
<u>4'-8"</u>	<u>No. 3</u>	<u>No. 3</u>	<u>4'-8"</u>	<u>No. 3</u>	<u>No. 3</u>
<u>5'-4"</u>	<u>No. 3</u>	<u>No. 3</u>	<u>5'-4"</u>	<u>No. 3</u>	<u>No. 3</u>
<u>6'-0"</u>	<u>No. 3</u>	<u>No. 3</u>	<u>6'-0"</u>	<u>No. 3</u>	<u>No. 3</u>
<u>6'-8"</u>	<u>No. 3</u>	<u>No. 3</u>	<u>6'-8"</u>	<u>No. 3</u>	<u>No. 4</u>
<u>7'-4"</u>	<u>No. 3</u>	<u>No. 4</u>	<u>7'-4"</u>	<u>No. 3</u>	<u>No. 5</u>
<u>8'-0"</u>	<u>No. 3</u>	<u>No. 5</u>	<u>8'-0"</u>	<u>No. 3</u>	<u>No. 5</u>

<u>1. All reinforcing bars shall comply with ASTM A615, Grade 60.</u>
<u>2. Minimum 28 day compressive strength of the lintel shall be 3,000 psi.</u>

Reason: Situations often arise in the field whereby it is not practical to have a continuous footing around the perimeter of a residence, such as at the transition between a basement wall and a stem wall below a garage, which is further complicated due to excavating around the basement. A common solution to this situation is to span between the stem wall footer and basement wall footer using a precast lintel to support surcharge loads applied from above.

This change proposes to introduce an alternative design and construction option to allow discontinuous footers when complying with the requirements of the proposed new Figure 403.1(1). Similar detailing has been used successfully for years in various regions of the country.

The detailing options presented here are applicable only to structures assigned to SDC A, B, and C. For higher seismic design categories, the provisions of Section R403.1.3 are still applicable.

Cost Impact: This code change will not increase the cost of construction.

RB210-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1-RB-THOMPSON.doc

RB211 – 13
R403.1.1, Table R403.1(1), Table 403.1(2) (New), Table R403.1(3) (NEW)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association, (BajnaiC@chesterfield.gov), James R. Baty II, Technical Director of Concrete Foundations Association, and Matthew R. Senecal, Senior Engineer, American Concrete Institute

Revise as follows:

R403.1.1 Minimum size. The minimum ~~sizes~~ width, W, and thickness, T, for concrete ~~and masonry~~ footings shall be ~~as set forth~~ in accordance with Table R403.1(1) through R403.1(3) and Figure R403.1(1). The footing width~~, W,~~ shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. ~~Spread footings shall be at least 6 inches (152 mm) in thickness, T.~~ Footing projections, P, shall be at least 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3).

~~TABLE R403.1~~
~~MINIMUM WIDTH OF CONCRETE PRECAST OR MASONRY FOOTINGS (inches)~~[a]

TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT FRAME CONSTRUCTION

Snow load or Roof Live Load	Story and Type of Structure with Light Frame	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	22 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 story - slab on grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - plus basement	25 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
30 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	23 x 6	17 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	3 story - slab on grade	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - plus basement	26 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
50 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	21 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	25 x 7	19 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	3 story - slab on grade	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	22 x 6	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 story - plus basement	28 x 9	21 x 6	17 x 6	14 x 6	12 x 6	12 x 6
70 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	18 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	24 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	21 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	27 x 9	20 x 6	16 x 6	14 x 6	12 x 6	12 x 6
	3 story - slab on grade	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	25 x 7	18 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	3 story - plus basement	30 x 10	23 x 6	18 x 6	15 x 6	13 x 6	12 x 6

1. Interpolation allowed. Extrapolation is not allowed
2. Based on 32 foot wide house with load bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).

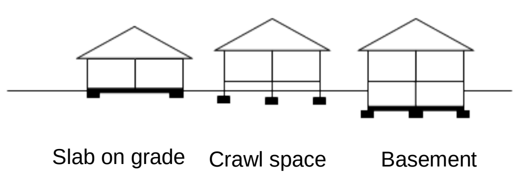


TABLE R403.1(2)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR CONCRETE FOOTINGS FOR LIGHT FRAME CONSTRUCTION WITH BRICK VENEER

Snow load or Roof Live Load	Story and Type of Structure with Brick Veneer	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	21 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	26 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
	3 story - slab on grade	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	26 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
	3 story - plus basement	32 x 11	24 x 7	19 x 6	16 x 6	14 x 6	12 x 6
30 psf	1 story - slab on grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	22 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	22 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	27 x 9	21 x 6	16 x 6	14 x 6	12 x 6	12 x 6
	3 story - slab on grade	21 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	27 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
	3 story - plus basement	33 x 11	24 x 7	20 x 6	16 x 6	14 x 6	12 x 6
50 psf	1 story - slab on grade	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	24 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	24 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 story - plus basement	29 x 10	22 x 6	18 x 6	15 x 6	13 x 6	12 x 6
	3 story - slab on grade	24 x 7	18 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 story - with crawl space	29 x 9	22 x 6	17 x 6	14 x 6	12 x 6	12 x 6
	3 story - plus basement	35 x 12	26 x 8	21 x 6	17 x 6	15 x 6	13 x 6
70 psf	1 story - slab on grade	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	26 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
	2 story - slab on grade	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	26 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
	2 story - plus basement	32 x 11	24 x 7	19 x 6	16 x 6	14 x 6	12 x 6
	3 story - slab on grade	26 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
	3 story - with crawl space	31 x 11	23 x 7	19 x 6	16 x 6	13 x 6	12 x 6
	3 story - plus basement	37 x 13	28 x 9	22 x 6	18 x 6	16 x 6	14 x 6

1. Interpolation allowed. Extrapolation is not allowed
2. Based on 32 foot wide house with load bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).

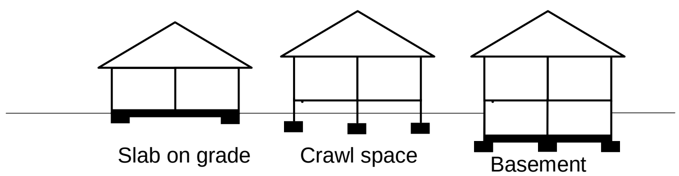
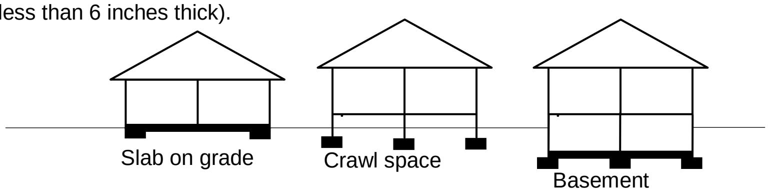


TABLE R403.1(3)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR FULL MASONRY WALL CONSTRUCTION

Snow load or Roof Live Load	Story and Type of Structure with CMU	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 story - slab on grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	25 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
	2 story - slab on grade	23 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	29 x 9	22 x 6	17 x 6	14 x 6	12 x 6	12 x 6
	2 story - plus basement	35 x 12	26 x 8	21 x 6	17 x 6	15 x 6	13 x 6
	3 story - slab on grade	32 x 11	24 x 7	19 x 6	16 x 6	14 x 6	12 x 6
	3 story - with crawl space	38 x 14	28 x 9	23 x 6	19 x 6	16 x 6	14 x 6
	3 story - plus basement	43 x 17	33 x 11	26 x 8	22 x 6	19 x 6	16 x 6
30 psf	1 story - slab on grade	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	26 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
	2 story - slab on grade	24 x 7	18 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	30 x 10	22 x 6	18 x 6	15 x 6	13 x 6	12 x 6
	2 story - plus basement	36 x 13	27 x 8	21 x 6	18 x 6	15 x 6	13 x 6
	3 story - slab on grade	33 x 12	25 x 7	20 x 6	17 x 6	14 x 6	12 x 6
	3 story - with crawl space	39 x 14	29 x 9	23 x 7	19 x 6	17 x 6	14 x 6
	3 story - plus basement	44 x 17	33 x 12	27 x 8	22 x 6	19 x 6	17 x 6
50 psf	1 story - slab on grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	23 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 story - slab on grade	21 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 story - with crawl space	25 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
	2 story - plus basement	30 x 10	23 x 6	18 x 6	15 x 6	13 x 6	12 x 6
	3 story - slab on grade	27 x 8	20 x 6	20 x 6	13 x 6	12 x 6	12 x 6
	3 story - with crawl space	32 x 11	24 x 7	19 x 6	16 x 6	14 x 6	12 x 6
	3 story - plus basement	36 x 13	27 x 9	22 x 6	18 x 6	16 x 6	14 x 6
70 psf	1 story - slab on grade	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 story - with crawl space	25 x 7	18 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	1 story - plus basement	30 x 10	23 x 6	18 x 6	15 x 6	13 x 6	12 x 6
	2 story - slab on grade	29 x 9	22 x 6	17 x 6	14 x 6	12 x 6	12 x 6
	2 story - with crawl space	34 x 12	26 x 8	21 x 6	17 x 6	15 x 6	13 x 6
	2 story - plus basement	40 x 15	30 x 10	24 x 7	20 x 6	17 x 6	15 x 6
	3 story - slab on grade	38 x 14	28 x 9	23 x 6	19 x 6	16 x 6	14 x 6
	3 story - with crawl space	43 x 16	32 x 11	26 x 8	21 x 6	18 x 6	16 x 6
	3 story - plus basement	49 x 19	37 x 13	29 x 10	24 x 7	21 x 6	18 x 6

1. Interpolation allowed. Extrapolation is not allowed
2. Based on 32 foot wide house with load bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).



Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The existing table was based on:

- a snow load of 50 psf
- 20 feet of tributary roof area
- 16 feet of tributary floor area
- 10 feet first floor height
- 8 feet second and third floor heights

For some parts of the country, the table's assumptions may not "fit" well.

1. These new tables factor in four snow live load conditions that were not previously acknowledged: 20 psf (the minimum allowed per Table R301.6), 30 psf, 50 psf and 70 psf (the maximum to be designed prescriptively by R301.2.3). Between these increments, the table allows for interpolation.
2. The tables account for additional soil bearing conditions. They now provide sizing for 1500 psf, 2000 psf, 2500 psf, and 3000 psf, 3500 psf and 4000psf soil bearing locations.
3. The tables take into consideration the same three framing types as the current table:
    a. Conventional light framing,
    b. Conventional light framing with veneer, and
    c. Cast-in-place concrete or full masonry wall construction.
4. The new tables were expanded to cover more conditions. They now differentiate houses built:
    a. 1, 2 and 3 stories built slab on grade (without a first floor load),
    b. 1, 2 and 3 stories built over a crawl space (with a first floor load and foundation wall/footing),
    c. 1, 2 and 3 stories built with basement (with a first floor load and basement walls. Previously, the table was silent on how to handle the extra load from a masonry or concrete basement wall).
5. The tables also provide the width of the footing based on the loads and the minimum projection – whichever governs. 6" is the minimum thickness already required by Section R403.1.1.
6. The table are based on the loading case of: TL = DL + .75LL
7. General assumptions, formulas and example follow for peer review:

ASSUMPTIONS

House width	32	
Roof ground snow load	varies	psf
Roof dead load	10	psf
Rafter length of house	16	ft
Roof overhang	2	ft
Attic live load	15	psf
Attic dead load	10	psf
Attic tributary width	8	ft
Third floor wall height	8	ft
Third floor wall materials	15	#/ vert ft
Third floor with veneer	45	#/ vert ft
Third floor with cmu wall	100	#/ vert ft
Third floor live load	22.5	psf
Third floor dead load	15	psf
Third floor tributary length	8	ft
Second floor wall height	9	ft
Second floor wall materials	15	#/ vert ft
Second floor with veneer	45	#/ vert ft
Second floor with cmu wall	100	#/ vert ft
Second floor live load	22.5	psf
Second floor dead load	15	psf
Second floor tributary length	8	ft
First floor wall height	10	ft
First floor with light frame	15	#/ vert ft
First floor with veneer	45	#/ vert ft
First floor with cmu wall	100	#/ vert ft
First floor live load	30	psf
First floor dead load	15	psf
First floor tributary length	8	ft
Crawl wall height	3	ft
Basement wall height	10	ft
Wall thickness	10	in
Basement/crawl floor wall materials	125	pcf
Footing width (min)	12	in
Footing thickness (min)	6	in
Concrete weight	150	pcf
	0.0868	pci

SAMPLE CALCULATION WITH FORMULAS

CMU CONSTRUCTION BASED ON 50 psf SNOW LOAD

	DESIGN PARAMETERS (variables)	1 story slab on grade		1 story with crawl		1 story with basement		2 story slab on grade		2 story with crawl		2 story with basement		3 story slab on grade		3 story with crawl		3 story with basement	
Roof load	(Roofspan/2 + Overhangspan) * (Roof-DL + (.75*Roof-LL))	855		855		855		855		855		855		855		855		855	
Attic Floor load	Roofspan/4 * (Attic-DL + .75(Attic-LL)	200		200		200		200		200		200		200		200		200	
TF Wall load	TFht * Wwt													480		480		480	
TF Floor load	Roofspan/4 * (TF-DL + (.75(TF-LL))													300		300		300	
SF Wall load	SFht * Wwt							540		540		540		540		540		540	
SF Floor load	Roofspan/4 * (SF-DL + (.75(SF-LL))							300		300		300		300		300		300	
FF Wall load	FFht * Wwt	600		600		600		600		600		600		600		600		600	
FF Floor load	Rspan/4 * (FF-DL + (.75FF-LL))			360		360				360		360				360		360	
Crawl Wall load	Cht * Cth / 12 * Cwt			250						250						250			
Basement Wall load	Bth * Bthick / 12 * Bwt					833						833						833	
Footing	Footthick / 12 * Footwidth / 12 * Wtcond	75		75		75		75		75		75		75		75		75	
CALCULATED LOAD (plf)		1730		2340		2923		2570		3180		3763		3350		3960		4543	
	Footing width is the greater of: 6" minimum or (Footing width - wall thickness) / 2																		
Soil bearing capacity variances (psf)	1500	14	6	19	6	23	7	21	6	25	8	30	10	27	8	32	11	36	13
	2000	10	6	14	6	18	6	15	6	19	6	23	6	20	6	24	7	27	9
	2500	8	6	11	6	14	6	12	6	15	6	18	6	16	6	19	6	22	6
	3000	7	6	9	6	12	6	10	6	13	6	15	6	13	6	16	6	18	6
	3500	6	6	8	6	10	6	9	6	11	6	13	6	11	6	14	6	16	6
	4000	5	6	7	6	9	6	8	6	10	6	11	6	10	6	12	6	14	6

Cost Impact: The code change proposal may increase the cost of construction.

RB211-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1(1)-RB-BAJNAI-BATY-SENECAL-BCAC.doc

RB212 – 13
Figure R403.1(1), Figure R403.1(2), Figure R403.1(3), R403.1.3.2, Figure R403.1.3.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaiC@chesterfield.gov)

Revise as follows:

~~FIGURE R403.1(1)~~
~~CONCRETE AND MASONRY FOUNDATION DETAILS~~

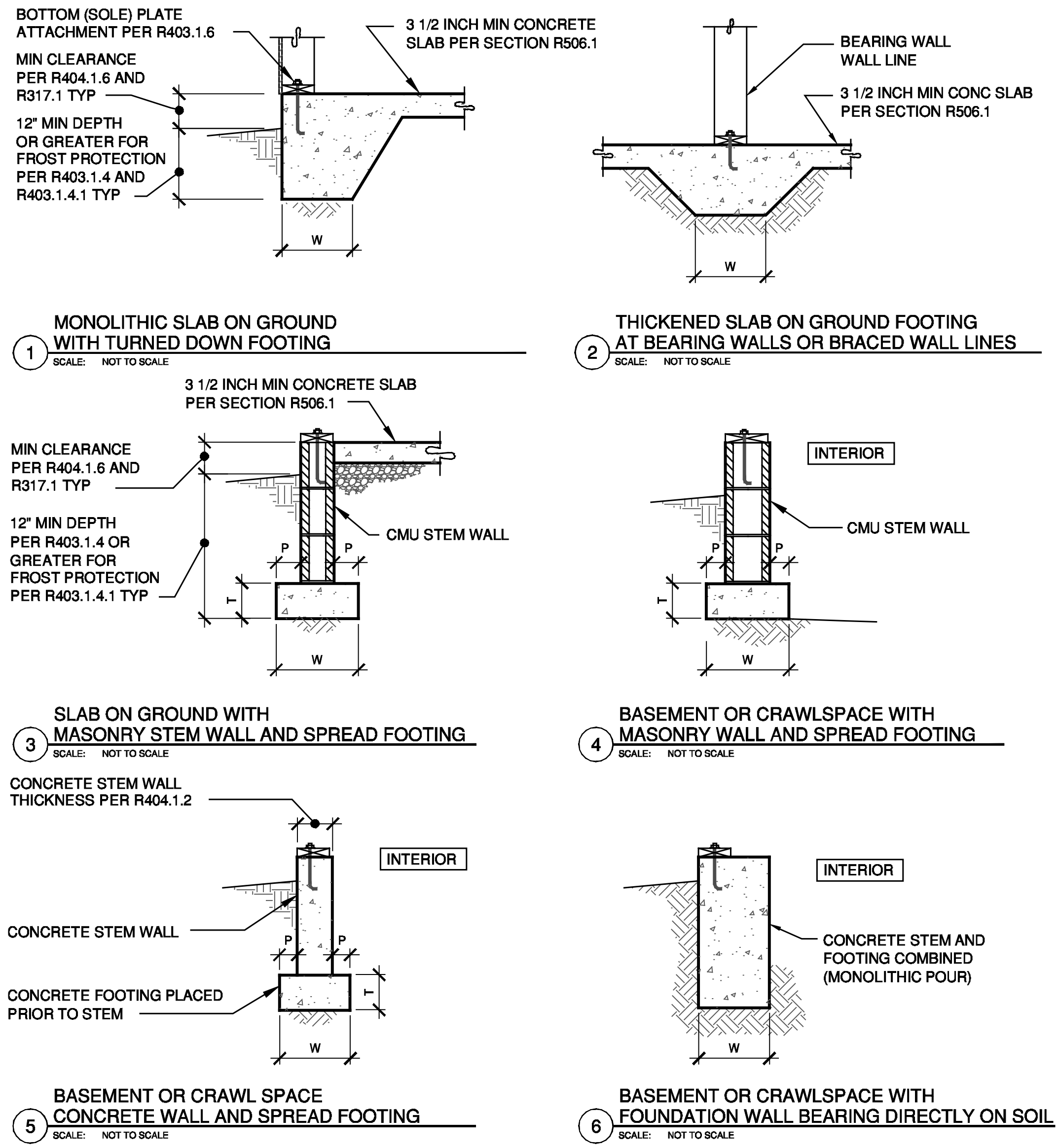


FIGURE R403.1(1)

PLAIN CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEMWALLS IN SDC A, B AND C a, b, c, d, e, f, g

W=WIDTH OF FOOTING, T=THICKNESS OF FOOTING AND P=PROJECTION PER SECTION R403.1.1.

a. SEE SECTION R404.3 FOR SILL REQUIREMENTS.

b. SEE SECTION R403.1.6 FOR SILL ATTACHMENT.

c. SEE SECTION R506.2.3 FOR VAPOR BARRIER REQUIREMENTS.

d. SEE SECTION R403.1 FOR BASE

e. SEE FIGURE R403.1(2) FOR ADDITIONAL FOOTING REQUIREMENTS FOR STRUCTURES IN SDC D0, D1 AND D2 AND TOWNHOUSES IN SDC C

f. SEE SECTION R408 FOR UNDERFLOOR VENTILATION AND ACCESS REQUIREMENTS.

g. SEE SECTION R403.1.3.4 FOR REINFORCEMENT REQUIREMENTS.

FIGURE R403.1(1)

PLAN CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEMWALLS OM SDC Do, D_1 AND D_2 [a,b,c,d,e,f,g]

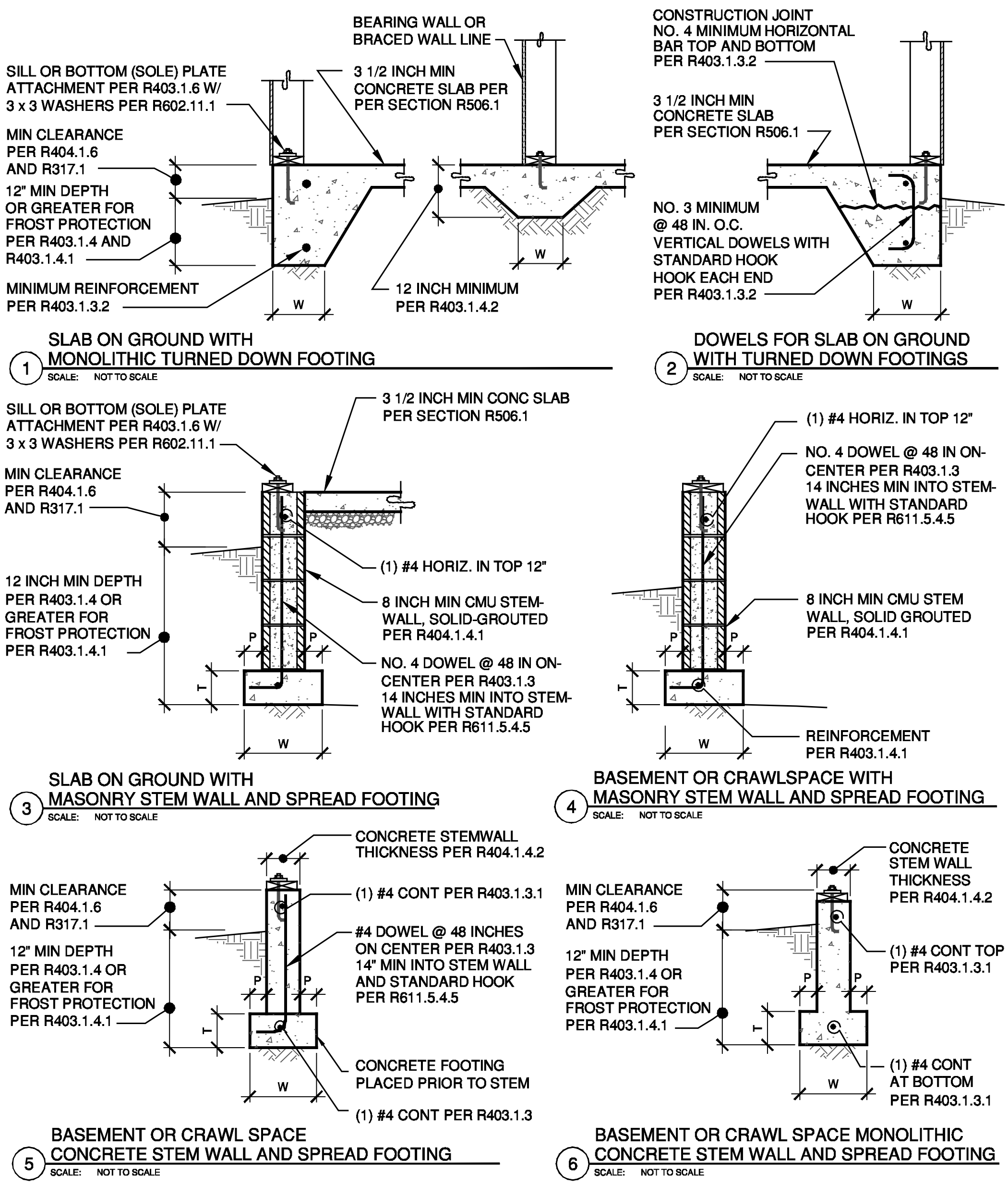


FIGURE R403.1(2)
REINFORCED CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEMWALLS IN SDC D0, D1 AND D2 [a, b, c, d, e, f, g]

W=WIDTH OF FOOTING, T=THICKNESS OF FOOTING AND P=PROJECTION PER SECTION R403.1.1.
a. SEE SECTION R404.3 FOR SILL REQUIREMENTS.
b. SEE SECTION R403.1.6 FOR SILL ATTACHMENT.
c. SEE SECTION R506.2.3 FOR VAPOR BARRIER REQUIREMENTS.
d. SEE SECTION R403.1 FOR BASE
f. SEE SECTION R408 FOR UNDERFLOOR VENTILATION AND ACCESS REQUIREMENTS.
g. SEE SECTION R403.1.3.4 FOR REINFORCEMENT REQUIREMENTS.

FIGURE R403.1(2)
REINFORCED CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEMWALLS IN SDC D_O, D_1 AND D_2 [a,b,c,d,e,f,g]

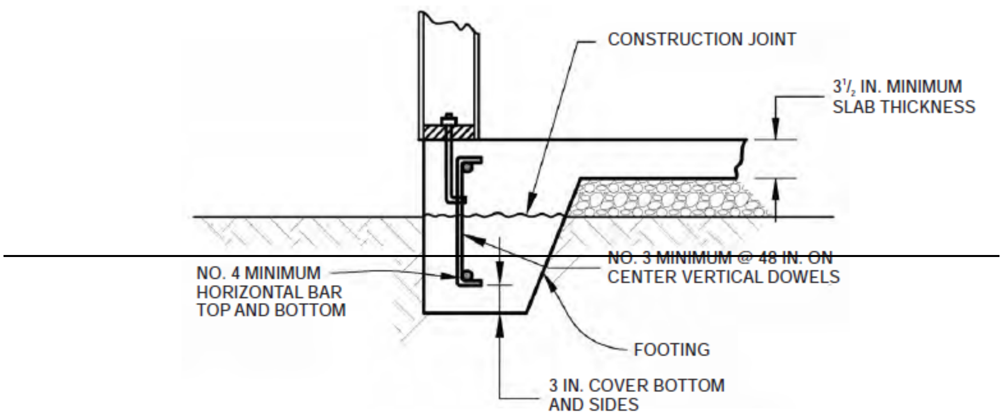
FIGURE ~~R403.1(2)~~ R403.1(3)
PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION

FIGURE ~~R403.1(3)~~ R403.1(4)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION

R403.1.3.2 Slabs-on-ground with turned-down footings. Slabs on ground with turned down footings shall have a minimum of one No. 4 bar at the top and the bottom of the footing

Exception: For slabs-on-ground cast monolithically with the footing, locating one No. 5 bar or two No. 4 bars in the middle third of the footing depth shall be permitted as an alternative to placement at the footing top and bottom.

Where the slab is not cast monolithically with the footing, No. 3 or larger vertical dowels with standard hooks on each end shall be provided in accordance with Figure ~~R403.1.3.2~~ R403.1(2), detail 2. Standard hooks shall comply with Section R611.5.4.5.



For SI: 1 inch = 25.4 mm.

FIGURE R403.1.3.2
DOWELS FOR SLABS-ON-GROUND WITH TURNED-DOWN FOOTINGS

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

This proposal is to revise and update the existing footing figures in the code. The revised figures improve the graphic quality of the figures and add information that is helpful to the code user. In addition, the current figures do not show, describe or address the specific reinforcement requirements for Seismic Design Categories D0, D1 and D2. Initial attempts to incorporate the SDC reinforcement requirements into the set of figures resulted in overly complex details that would contain information not necessary to code users in lower SDC's. Therefore, the committee decided to generate a second set of figures specifically detailing the reinforcement requirements for the applicable SDC's.

This proposal also moves existing figure R403.1.3.2 to Figure R403.1(2) and changes the reference in section R403.1.3.2. The footnotes were also expanded to alert the code user to other applicable sections relating to foundations but were not necessarily helpful to add to the figures such as vapor barriers and ventilation.

This proposal does not change any requirements in the current code and are a great improvement to the code enabling the code user to visualize the code requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

RB212-13

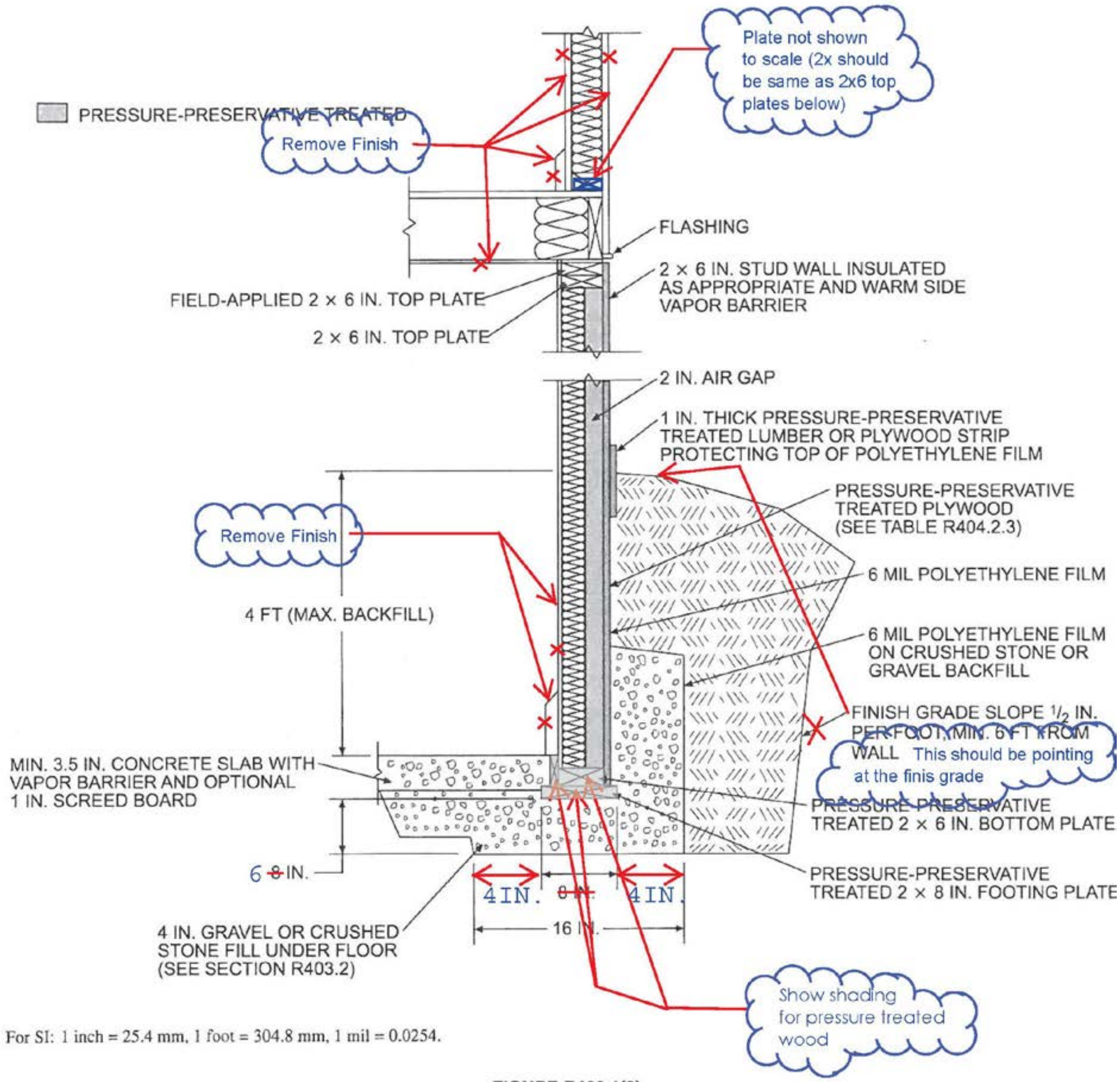
Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1(1)-F-RB-BAJNAI-BCAC.doc

RB213 – 13
Figure R403.1(2), Figure R403.1(3)

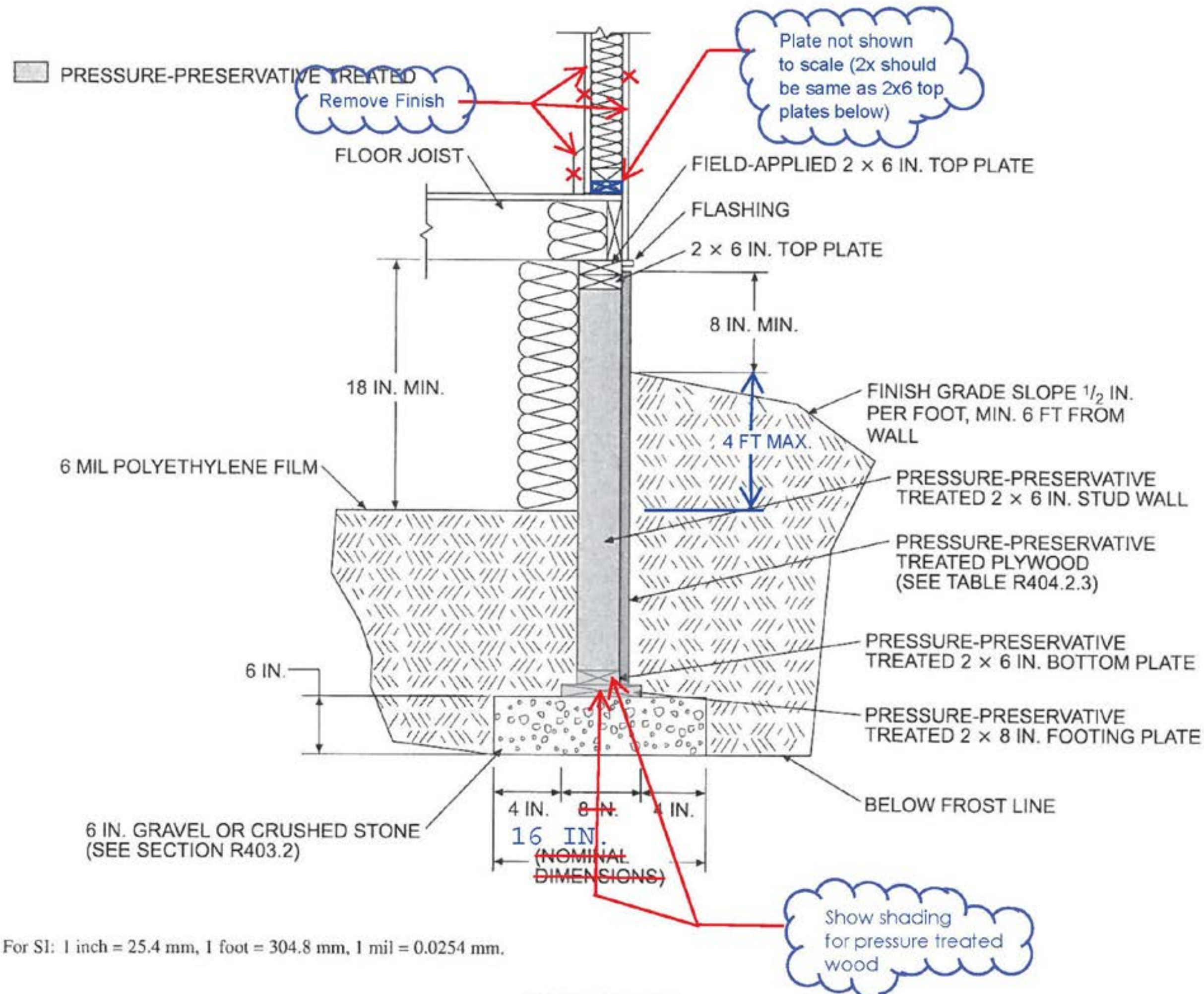
Proponent: Stephen Kerr, S.E., Josephson Werdowatz and Associates Inc., representing self (skerr@jwa-se.com)

Revise as follows:



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254.

FIGURE R403.1(2)
PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE R403.1(3)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION

Reason: The proposed changes to the permanent wood foundation contain numerous changes to help clarify and bring conformity to the two figures.

The proposal contains mostly editorial changes, including:

- The removal of the building finishes
- Shading the pressure treated wood bottom and foundation plates
- Making the thickness, width and the dimension callouts of the gravel or crushed stone fill similar in both figures
- Showing the floor sill plate dimensionally accurate
- In figure R403.1(2) for the finish grade callout, change the arrow to point to the actual grade

In Figure R403.1(3) the addition of the 4ft height limitation is to set the upper bound on the height of the wall, similar to the limitation of R403.1(2). With the dimensions as currently shown, there is no upper bound on the unbalanced backfill height.

Cost Impact: This code change proposal will not increase construction cost.

RB213-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1(2)F-RB-KERR.doc

RB214 – 13
R403.1.2, R602.10.9.1

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R403.1.2 Continuous footing in Seismic Design Categories D_0, D_1 and D_2. The *braced wall panels* at exterior walls of buildings located in Seismic Design Categories D_0, D_1 and D_2 shall be supported by continuous footings. ~~All required interior *braced wall panels* in buildings with plan dimensions greater than 50 feet (15 240 mm) shall also be supported by continuous footings.~~ For one-story buildings in Seismic Design Category D_2 and one- and two-story buildings in Seismic Design Categories D_0 and D_1, *braced wall panels* shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm). For two-story buildings in Seismic Design Category D_2, all *braced wall panels* shall be supported on continuous foundations.

Revise as follows:

R602.10.9.1 Braced wall panel support for Seismic Design ~~Category~~ Categories D_0, D_1 and D_2. ~~In one-story buildings located in Seismic Design Category D2, *braced wall panels* shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm). In two-story buildings located in Seismic Design Category D2, all *braced wall panels* shall be supported on continuous foundations.~~ In Seismic Design Categories D_0, D_1 and D_2 braced wall panel footings shall be as specified in Section R403.1.2.

~~**Exception:** Two-story buildings shall be permitted to have interior *braced wall panels* supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm) provided that:~~

~~1. The height of cripple walls does not exceed 4 feet (1219 mm).~~
~~2. First-floor *braced wall panels* are supported on doubled floor joists, continuous blocking or floor beams.~~
~~3. The distance between bracing lines does not exceed twice the building width measured parallel to the *braced wall line*.~~

Reason: The intent of this code change proposal is to clarify the foundation requirements under braced wall panels in high seismic areas. The existing provisions in Chapters 4 and 6 are contradictory and incomplete. In addition, there is no specific guidance on what to do in SDCs D_0 and D_1 for interior braced wall panels. Section R602.10.9.1 provides some guidance by inference that it tells you what to do in SDC D_2:

> "In one-story buildings located in Seismic Design Category D2, *braced wall panels* shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm)."

The inference is that in lesser SDCs, both one and two story buildings shall be supported on continuous footings at intervals exceeding 50 feet. This is in line with the existing Section 403.1.2.

In addition, Section R602.10.9.1, as written, provides for the SDC D_2, two story buildings, an exception to the "all braced wall panel" restriction, if all of 3 seemingly arbitrary limitations are met. The benefit of this unlikely exception is far exceeded by the complexity of the existing code with the exception. This proposal removed this unlikely exception and reformats the Section R602.10.9.1 information and moves it to the foundation chapter in Section R403.1.2.

Note that the exception is removed, making the code more stringent or removing a loophole, depending on your perspective. There is little doubt that it strengthens the foundation requirements for two-story buildings in SDC D_2. It certainly reduced a loop hole that weakens the code requirements for the most vulnerable of structures in a very limited area in the US.

Cost Impact: The code change proposal will increase the cost of construction in that it will eliminate the unlikely exception permitting two story structures in SDC D_2 to have minimal *braced wall panel* support.

RB214-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.2-RB-KEITH.doc

RB215 – 13
R403.1.2, R403.1.4.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee (BajnaiC@chesterfield.gov)

Revise as follows:

R403.1.2 Continuous footing in Seismic Design Categories D_0, D_1 and D_2. ~~The *braced wall panels* at~~ exterior walls of buildings located in Seismic Design Categories D_0, D_1 and D_2 shall be supported by continuous solid or fully grouted masonry or concrete footings. Other footing materials or systems shall be designed in accordance with accepted engineering practice. All required interior *braced wall panels* in buildings located in Seismic Design Categories D_0, D_1 and D_2 with plan dimensions greater than 50 feet (15 240 mm) shall also be supported by continuous solid or fully grouted masonry or concrete footings~~.~~ in accordance with Section R403.1.4.2.

R403.1.4.2 Bearing and braced wall panel support in Seismic Design Categories D_0, D_1 and D_2. ~~Seismic conditions~~ In Seismic Design Categories D_0, D_1 and D_2, interior footings supporting bearing walls or *braced wall panels,* ~~bracing walls~~ and cast monolithically with a slab on *grade*, shall extend to a depth of not less than 12 inches (305 mm) below the top of the slab.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The International Code Council's Building Code Action Committee identified several items in Chapter 4, "Foundations", that are in conflict with other provisions of the code or lack clarity. This proposal specifically addresses conflicts and confusing language.

In the current code, section R403.1 states,

*"**R403.1 General.** All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other approved structural systems which shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil."*

Then, for Seismic Design Categories D_0, D_1 and D_2 specifically, R403.1.2 repeats that requirement by specifying that the braced wall panels in exterior walls in Seismic Design Categories D_0, D_1 and D_2 are required to be supported by continuous footings. That portion of R403.1.2 is redundant and actually implies a conflict with other sections of code. The existing language is also in conflict with section R301.2.2.5 that allows braced wall panels supported on cantilevered floor framing.

As shown above, the general requirements of Section R403.1 refers to, "crushed stone footings and wood foundations". However, per sections R401.1 and R403.4.1, wood foundations and crushed stone footings are limited to use in Seismic Design Categories A, B and C. Section R403.1.2 is specifically addressing Seismic Design Categories D_0, D_1 and D_2 where they are not allowed without being designed. That clarification is made with this proposal.

This proposal is to change the first sentence to refer specifically to the requirement for Seismic Design Categories D_0, D_1 and D_2 and to note the limitations of wood and crushed stone footings.

The second sentence of R403.1.2 specifies another requirement of Seismic Design Categories D_0, D_1 and D_2.. The second sentence requires that interior braced wall panels are required to be supported by continuous footings at not greater than 50 intervals. That requirement is unchanged in this proposal but is clarified to specify continuous solid or fully-grouted masonry or concrete footings. Terminology is also changed in section R403.1.2 to correlate with current language in the wall bracing requirements of Chapter 6.

Cost Impact: The code change proposal will not increase the cost of construction.

RB215-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.2-RB-BAJNAI-BCAC.doc

RB216 – 13
R403.1.3, R403.1.3.1, R403.1.3.2, R403.1.3.5 (NEW), R403.1.3.5.1 (NEW), R403.1.3.5.2 (NEW), R403.1.3.5.3 (NEW), R403.1.3.5.4 (NEW), R403.1.3.6 (NEW), R403.1.4.2

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee (BajnaiC@chesterfield.gov)

Revise as follows:

R403.1.3 ~~Seismic reinforcing~~ Footing and stem wall reinforcing in Seismic Design Categories D_0, D_1 and D_2 . Concrete footings located in Seismic Design Categories D_0, D_1 and D_2, as established in Table R301.2(1), shall have minimum reinforcement in accordance with this section. ~~Bottom~~ ~~r~~Reinforcement shall be ~~located~~ installed in accordance with Section R403.1.3.5. ~~a minimum of 3 inches (76 mm) clear from the bottom of the footing.~~

~~In Seismic Design Categories D_0, D_1 and D_2 where a construction joint is created between a concrete footing and a stem wall, a minimum of one No. 4 bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to 3 inches (76 mm) clear of the bottom of the footing have a standard hook and extend a minimum of 14 inches (357 mm) into the stem wall.~~

~~In Seismic Design Categories D_0, D_1 and D_2 where a grouted masonry stem wall is supported on a concrete footing and stem wall, a minimum of one No. 4 bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to 3 inches (76 mm) clear of the bottom of the footing and have a standard hook. In Seismic Design Categories D_0, D_1 and D_2 masonry stem walls without solid grout and vertical reinforcing are not permitted.~~

> ~~**Exception:** In detached one- and two-family *dwellings* which are three stories or less in height and constructed with stud bearing walls, isolated plain concrete footings, supporting columns or pedestals are permitted.~~

~~**R403.1.3.1 Foundations with stemwalls.** Foundations with stem walls shall have installed a minimum of one No. 4 bar within 12 inches (305 mm) of the top of the wall and one No. 4 bar located 3 inches (76 mm) to 4 inches (102 mm) from the bottom of the footing.~~

R403.1.3.1 Concrete stem walls with concrete footings. In Seismic Design Categories D_0, D_1 and D_2 where a construction joint is created between a concrete footing and a concrete stem wall, a minimum of one No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to the bottom of the footing and shall have a standard hook and extend a minimum of 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R611.5.4.5. A minimum of one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the stem wall and one No. 4 horizontal bar shall be located three to four inches from the bottom of the footing.

R403.1.3.2 Masonry stem walls with concrete footings. In Seismic Design Categories D_0, D_1 and D_2 where a masonry stem wall is supported on a concrete footing, a minimum of one No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall extend to the bottom of the footing and have a standard hook and extend a minimum of 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R611.5.4.5. A minimum of one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the wall and one No. 4 horizontal bar shall be located three to four inches from the bottom of the footing. Masonry stem walls shall be solid grouted.

~~R403.1.3.2~~ R403.1.3.3 Slabs-on-ground with turned-down footings. In Seismic Design Categories D_0, D_1 and D_2, Slabs on ground cast monolithically with turned down footings shall have a minimum of one

No. 4 bar at the top and the bottom of the footing or one No. 5 bar or two No. 4 bars in the middle third of the footing depth..

> ~~**Exception:** For slabs-on-ground cast monolithically with the footing, locating one No. 5 bar or two No. 4 bars in the middle third of the footing depth shall be permitted as an alternative to placement at the footing top and bottom.~~

Where the slab is not cast monolithically with the footing~~,~~ one No. 3 or larger vertical dowels with standard hooks on each end shall be ~~provided~~ installed at not more than 4 feet (1219 mm) on center in accordance with Figure R403.1.3.2 . Standard hooks shall comply with Section R611.5.4.5.

~~**R403.1.4.2 Seismic conditions**~~ **R403.1.3.4 Interior bearing and braced wall panel footings in Seismic Design Categories D_0, D_1 and D_2.** In Seismic Design Categories D_0, D_1 and D_2, interior footings supporting bearing walls or *braced wall panels,* ~~bracing walls~~ and cast monolithically with a slab on *grade*, shall extend to a depth of not less than 12 inches (305 mm) below the top of the slab.

R403.1.3.5 Reinforcement. Footing and stem wall reinforcement shall comply with Sections R403.1.3.5.1 through R403.1.3.5.4.

R403.1.3.5.1 Steel reinforcement. Steel reinforcement shall comply with the requirements of ASTM A 615, A 706, or A 996. ASTM A 996 bars produced from rail steel shall be Type R. In buildings assigned to Seismic Design Category A, B or C, the minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). In buildings assigned to Seismic Design Category D0, D1 or D2, reinforcing steel shall comply with the requirements of ASTM A 706 for low-alloy steel with a minimum yield strength of 60,000 psi (Grade 60) (414 MPa).

R403.1.3.5.2 Location of reinforcement in wall. The center of vertical reinforcement in stem walls shall be located at the centerline of the wall. Horizontal and vertical reinforcement shall be located in footings and stem walls to provide the minimum cover required by Section R403.1.3.5.3.

R403.1.3.5.3 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system to prevent displacement during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (75 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be 1-1/2 inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be 3/4 inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover or 3/8 inch (10 mm).

R403.1.3.5.4 Lap splices. Vertical and horizontal reinforcement shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splice shall be in accordance with Table R611.5.4.(1) and Figure R611.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm). See Figure R611.5.4(1).

R403.1.3.6 Isolated concrete footings. In detached one- and two-family *dwellings* which are three stories or less in height and constructed with stud bearing walls, isolated plain concrete footings, supporting columns or pedestals are permitted.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The International Code Council's Building Code Action Committee identified several items in Chapter 4, "Foundations", that are in conflict with other provisions of the code or lack clarity. This proposal specifically addresses conflicts and confusing language in the current sections of code that address reinforcement required for Seismic Design Categories D0, D1 and D2.

The title and language in section R403.1.3 is changed for clarity. Additionally, a note is added that references a new section, R403.1.3.4, that defines the installation requirements for the reinforcement.

The existing language describing concrete stem walls and masonry stem walls on concrete footings are separated into two sections, “Concrete stem walls” and “Masonry stem walls” respectively.

Section R403.1.3.1 describes the existing requirements for the horizontal reinforcement at the top of the stem wall and the bottom of the footing. This proposal deletes that section and incorporates the language into the two sections describing the requirements for the stem wall, R403.1.3.1 and R403.1.3.2 respectively.

The language in the existing section R403.1.3.2 for slabs on ground is changed to clarify that this section is addressing turned down footings cast monolithically with the slab since there are new provisions in the code to allow turned down footings that are not cast monolithically with the slab. Also, the existing exception for the reinforcement to be installed in the middle third of the footing have been moved into the section instead of being an exception.

Cost Impact: The code change proposal will not increase the cost of construction.

RB216-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.3-RB-BAJNAI-BCAC.doc

RB217 – 13
R403.1.6

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org); Bonnie E. Manley, P.E., American Iron and Steel Institute

Revise as follows:

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates anchored to the foundation. Anchorage of cold-formed steel framing and sill plates supporting cold-formed steel framing shall be in accordance with this section and Sections R505.3.1 or R603.3.1.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with anchor bolts spaced a maximum of 6 feet (1829 mm) on center. Bolts shall be at least 1/2 inch (12.7 mm) in diameter and shall extend a minimum of 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. ~~Cold-formed steel framing systems shall be fastened to wood sill plates or anchored directly to the foundation as required in Section R505.3.1 or R603.3.1.~~

Reason: The purpose of this proposal is to clarify the foundation anchorage requirements for cold-formed steel framing systems. Currently, the anchorage requirements for cold-formed steel are part of a larger paragraph mostly concerning wood framing. This proposal moves the cold-formed steel requirements to a separate paragraph. This paragraph becomes “charging language” which points the user to the appropriate CFS provisions in Chapters 5 and 6. In addition, the language is revised to clarify that both the provisions of Section R403.1.6 and the applicable provisions of Section R505.3.1 (for cold-formed steel floor framing) and Section R603.3.1 (for cold-formed steel wall framing) need to be followed. This is to insure that anchor bolt spacing and embedment requirements specific to cold-formed steel and detailed in Sections R505.3.1 and R603.3.1 are not overlooked or inadvertently overridden.

Cost Impact: The code change proposal will not increase the cost of construction.

RB217-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.6-RB-EHRLICH-MANLEY.doc

RB218 – 13
R403.1.6

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahg.org)

Revise as follows:

R403.1.6 Foundation anchorage. Sill plates and walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum 1/2 inch (12.7 mm) diameter anchor bolts spaced a maximum of 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts. Bolts shall ~~be at least 1/2 inch (12.7 mm) in diameter and shall~~ extend a minimum of 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Cold-formed steel framing systems shall be fastened to wood sill plates or anchored directly to the foundation as required in Section R505.3.1 or R603.3.1.

Exceptions:

~~1. Foundation anchorage, spaced as required to provide equivalent anchorage to 1/2-inch-diameter (13 mm) anchor bolts.~~

~~2~~1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in item 8 of Table R602.3(1).

~~3~~2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset braced wall panels to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in item 8 of Table R602.3(1).

Reason: The purpose of this proposal is to clarify the foundation anchorage requirements by moving the current exception for alternate foundation anchor systems providing equivalent capacity to ½" anchor bolts spaced at 6'-0" (or as otherwise required by the code or design) into the main text of R403.1.6. The revised language is similar to 2012 IBC Section 2308.6. This will place the use of wedge anchors, expansion anchors, adhesive anchors, mudsill anchors and other alternatives approved by the building official on an equal level with cast-in-place anchor bolts.

Cost Impact: The code change proposal will not increase the cost of construction.

RB218-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.6-RB-EHRLICH.doc

RB219 – 13
R403.1.6

Proponent: Hope Medina, Colorado Code Consulting, representing Colorado Chapter of ICC (hmedina@coloradocode.net)

Revise as follows:

R403.1.6 Foundation anchorage. Sill plates and walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with anchor bolts spaced a maximum of 6 feet (1829 mm) on center. Bolts shall be at least 1/2 inch (12.7 mm) in diameter and shall extend a minimum of 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. <u>The bolts shall be located a minimum 1 ¾" from the plate's edge or in the middle third of the plate's edge.</u> A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Cold-formed steel framing systems shall be fastened to wood sill plates or anchored directly to the foundation as required in Section R505.3.1 or R603.3.1.

Exceptions:

1. Foundation anchorage, spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts.
2. Walls 24 inches (610 mm) total length or shorter connecting offset *braced wall panels* shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent *braced wall panels* at corners as shown in item 8 of Table R602.3(1).
3. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent *braced wall panels* at corners as shown in item 8 of Table R602.3(1).

Reason: It has become a common occurrence to see an anchor bolt placed at the edge of the sole plate, and on many occasions the threads of the bolt are visible. The "practicing industry standard" is for the bolt to be located at least two bolt diameters from the plate's edge, but there is nothing in the IRC to govern this. We require two bolts per plate, within 12" of a break, and spaced no more than 6 feet apart, but nothing plainly referencing it's placement from the plates edge. Having a specified placement of the bolt in the bottom plate allows for proper enforcement while still giving some flexibility to the contractors.
Simpson Strong Tie has performed tests demonstrating that the bolt lost the expected anchoring capacity when placed closer than 1 ¾" from the plate's edge.

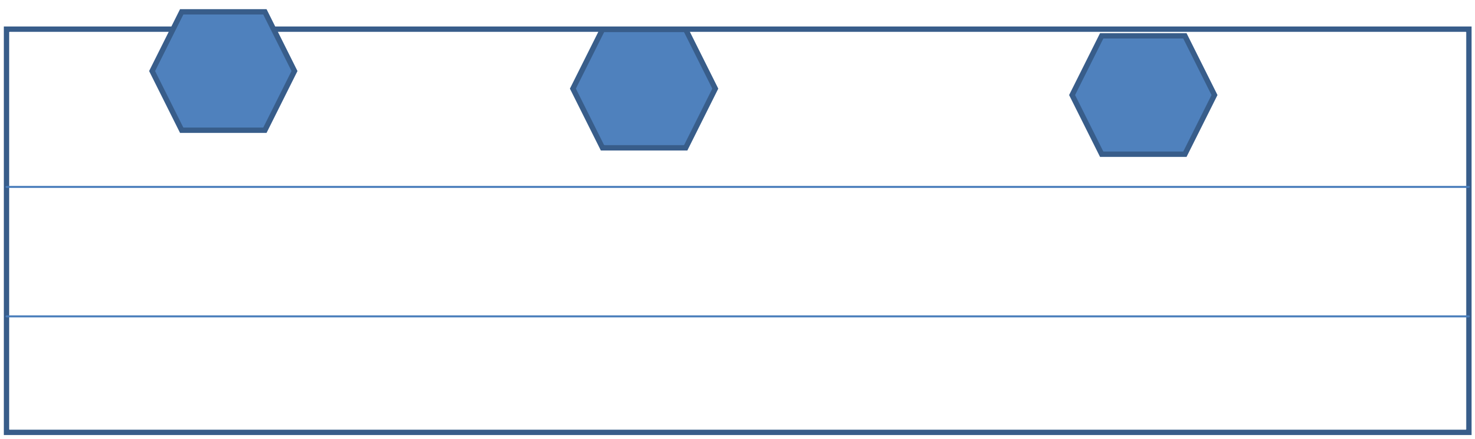
Both the Simpson Strong Tie Wood Construction Connectors 2011-2012 edition and the USP Structural Connectors state that their connectors must have a minimum placement of 1 ¾ inches from the edge.
The IRC reference the NDS for wood design for items not covered in the code like wood edge and end distances. The 2012 NDS has edge distance of ¾" for shear and 2" for wind loads (Table 11.5.1C). So if the edge distance is 1-1/8" you would need to reduce the anchor capacity with an 0.56 allowable load adjustment factor (1.125/2) when resisting wind loads. So you can space in the middle 1/3 of plate, but you may need to increase the number of bolts for wind.

In chapter 7 of the National Design Specifications for wood construction reference of anchor bolt placement.

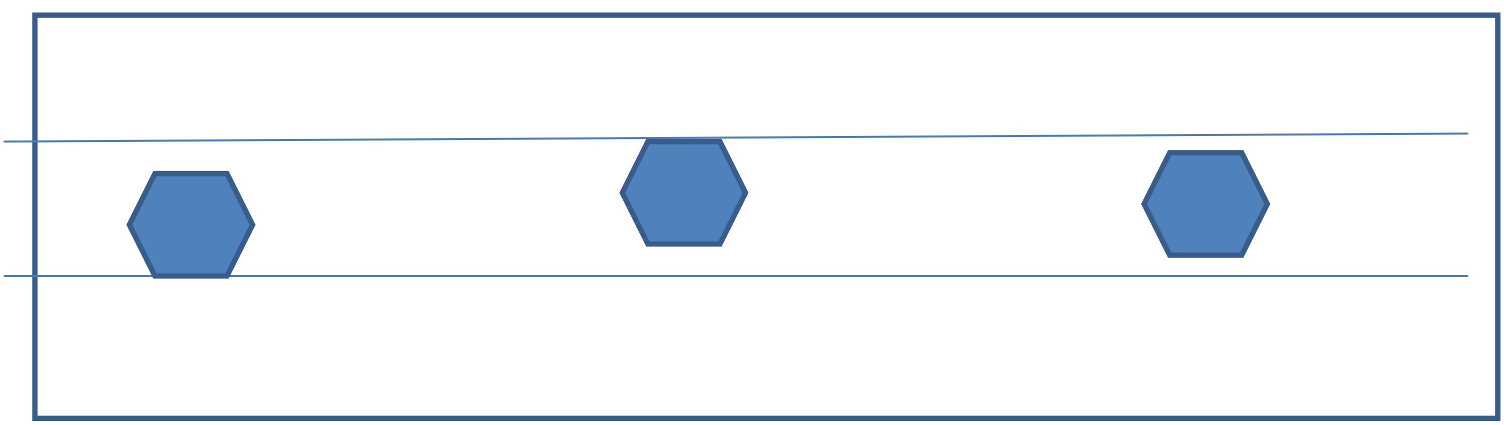
Spacing, Edge, and End Distance

The center-to-center distance along the grain should be at least four times the bolt diameter for parallel-to-grain loading. The minimum center-to-center spacing of bolts in the across-the-grain direction for loads acting through metal side plates and parallel to the grain need only be sufficient to permit the tightening of the nuts. For wood side plates, the spacing is controlled by the rules applying to loads acting parallel to grain if the design load approaches the bolt-bearing capacity of the side plates. When the design load is less than the bolt-bearing capacity of the side plates, the spacing may be reduced below that required to develop their maximum capacity.

COMMON PLACEMENT OF BOLTS IN THE FIELD



PROPER PLACEMENT OF BOLTS WITH CODE CHANGE



Cost Impact: The code change proposal will not increase the cost of construction.

RB219-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.6-RB-MEDINA.doc

RB220 – 13
R403.1.8.1

Proponent: Paul L. Hilpman, PhD., R.G., L.G., representing self (hilpmanpa@yahoo.com)

Revise as follows:

R403.1.8.1 Expansive soils classifications. Soils meeting all four of the following provisions shall be considered expansive, except that tests showing compliance with Items 1, 2 and 3 shall ~~not be required if the test prescribed in Item 4 is conducted:~~ only apply to natural soils, and tests to showing compliance with Item 4 shall only apply to mechanically compacted soils:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75mm), determined in accordance with ASTM D 422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion Index greater than 20, determined in accordance with ASTM D 4829.

Reason: Most foundations for One- and Two-Family Dwellings are constructed on *natural soils* rather than mechanically *compacted soils*. Historically, the geotechnical community has relied on ASTM D 4318 and D 422 tests to predict the engineering behavior of *natural soils* such as compressibility, hydraulic conductivity (permeability), shrink-swell, and shear strength. In contrast, the ASTM D 4829 test is specifically designed to provide an indication of swelling potential of a mechanically *compacted soil*. Accordingly, this proposal is an attempt to make it clear that provisions 1, 2 & 3 are only appropriate for evaluating *natural soils* and that provision 4 is only appropriate for evaluating *compacted soils*. As presently phrased in the 2012 Edition of the IRC for One- and Two-Family Dwellings, this distinction is articulated in an ambiguous manner. Building Officials in cities that have adopted the present wording have had to accept builder's test results from ASTM D 4829 that indicate a "very low" expansion index when, in fact, none of the soils at the building site were to be compacted. When subject to ASTM D 4318 and D 422 tests, the results indicated that the CH soil was highly expansive.

Cost Impact: The code change proposal will not increase the cost of construction.

RB220-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.1.8.1-RB-HILPMAN.doc

RB221 – 13
Table R403.3(1)

Proponent: Betsy Steiner, EPS Molders Association (emsteiner@epsindustry.org)

Revise as follows:

TABLE R403.3(1)
MINIMUM FOOTING DEPTH AND INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS[a]

e. Horizontal insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.

(Portions of Table not shown remain unchanged)

Reason: Expanded polystyrene is widely recognized for use in below grade applications, specifically geofoam installments (as recognized by the Federal Highway Administration) as a means to achieve slope stabilization, bridge abutments and other seismic loading functions in all climate zones, including those experiencing severe freeze-thaw cycling. The National Association of Home Builders Research Center also recognizes expanded polystyrene as suitable for horizontal applications in its publication “Revised Builder’s Guide To Frost Protected Shallow Foundations,” September 2004.

Cost Impact: This code change proposal will not increase the cost of construction.

RB221-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.3(1)T-RB-STEINER.doc

RB222 – 13
Figure R403.4(1), Table R403.4

Proponent: Paul Edward Helderman Jr., Codes and Standards Manager, Superior Walls of America, Ltd., representing Lancaster County Code Officials (LANCODE)

Revise as follows:

TABLE R403.4
MINIMUM DEPTH OF CRUSHED STONE FOOTINGS (D), (inches)

Number of Stories	Uniform Wall Load	Load Bearing Value of Soil (psf)															
		1500				2000				3000				4000			
		MH,CH,CL,ML				SC,GC,SM,GM,SP,SW				GP,GW							
		Wall width (inches)				Wall width (inches)				Wall width (inches)				Wall width (inches)			
		6	8	10	12	6	8	10	12	6	8	10	12	6	8	10	12
Conventional light-frame construction																	
1-Story	(1100plf)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(1800plf)	8	6	4	4	6	4	4	4	6	4	4	4	6	4	4	4
3-Story	(2900plf)	16	14	12	10	10	8	6	6	6	4	4	4	6	4	4	4
4-inch brick veneer over light-frame or 8-inch hollow concrete masonry																	
1-Story	(1500plf)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(2700plf)	14	12	10	8	10	8	6	4	6	4	4	4	6	4	4	4
3-Story	(4000plf)	22	22	20	18	16	14	12	10	10	8	6	4	6	4	4	4
8-inch solid or fully grouted masonry																	
1-Story	(2000plf)	10	8	6	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(3600plf)	20	18	16	16	14	12	10	8	8	6	4	4	6	4	4	4
3-Story	(5300plf)	32	30	28	26	22	22	20	18	10	12	10	8	10	8	6	4

For SI: 1 inch =25.4 mm, ~~1 pound per square inch = 6.89 pounds per linear foot,~~ 1 plf = ~~2.44~~14.6 N/m, 1 pounds per square foot = 47.9 N/m^2

Notes:

1. Linear interpolation of stone depth between wall widths is permitted within each Load Bearing Value of Soil (psf)

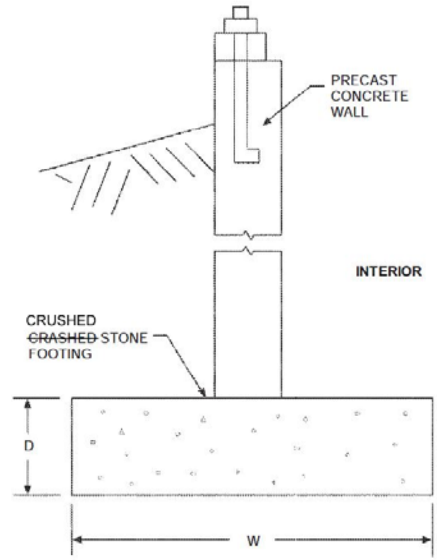


FIGURE R403.4(1)
BASEMENT OR CRAWL SPACE WITH PRECAST FOUNDATION WALL BEARING ON CRUSHED STONE

Reason: This table is already in the code and it shows a code official a simple way to estimate the crushed stone depth for any precast foundation wall between 6 inches to 12 inches in width. The reason for this proposal is to add headings column 1 and 2 for clarification. The conversion information at the bottom of the table was incorrect and has already been identified by the technical staff of the ICC and will be published as an erratum and corrected in the next printing of the 2012 IRC and the 2009 IRC.

A note has been added pointing out that linear interpolation may be used to determine stone depth for wall widths not shown on the table if those wall widths are between 6 and 12 inches.

For example: An 11 inch precast foundation wall is setting on 1500 psf soil and it will be carrying a uniform wall load of 4000plf because the house will be a 3-story 4-inch brick veneer over light-frame construction. To calculate the minimum depth of the crushed stone footing required by the table you must interpolate between 18 inches of stone for a 12 inch wall width, and 20 inches of stone for a 10 inch wall width. This gives you an interpolated value of 19 inches minimum depth of crushed stone for a 3 story home with 4-inches of brick veneer over light-frame construction (4000plf) for an 11 inch wall width setting on 1500 psf soil. Note: You cannot interpolate between two different soil bearing values of soil.

Example: Answer = **19 inches** - based on interpolation (3 story home, 11 inch precast foundation wall width, on 1500 psf soil.)

TABLE R403.4
MINIMUM DEPTH OF CRUSHED STONE FOOTINGS (D), (inches)

<u>Number of Stories</u>	<u>Uniform Wall Load</u>	Load Bearing Value of Soil (psf)															
		1500				2000				3000				4000			
		MH,CH,CL,ML				SC,GC,SM,GM,SP,SW				GP,GW							
		Wall width (inches)				Wall width (inches)				Wall width (inches)				Wall width (inches)			
		6	8	10	12	6	8	10	12	6	8	10	12	6	8	10	12
Conventional light-frame construction																	
1-Story	(1100plf)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(1800plf)	8	6	4	4	6	4	4	4	6	4	4	4	6	4	4	4
3-Story	(2900plf)	16	14	12	10	10	8	6	6	6	4	4	4	6	4	4	4
4-inch brick veneer over light-frame or 8-inch hollow concrete masonry																	
1-Story	(1500plf)	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(2700plf)	14	12	10	8	10	8	6	4	6	4	4	4	6	4	4	4
3-Story	(4000plf)	22	22	20	18	16	14	12	10	10	8	6	4	6	4	4	4
8-inch solid or fully grouted masonry																	
1-Story	(2000plf)	10	8	6	4	6	4	4	4	6	4	4	4	6	4	4	4
2-Story	(3600plf)	20	18	16	16	14	12	10	8	8	6	4	4	6	4	4	4
3-Story	(5300plf)	32	30	28	26	22	22	20	18	10	12	10	8	10	8	6	4

No other changes were made to the table, but for clarification, please note that calculations will show that the plf values for the Uniform Wall Loads shown in the table were directly determined from the loads and footing widths found in IRC Table R403.1, and thereby the crushed stone depths are calculated to approximate the same load bearing widths on the soil as the concrete footings found in Table R403.1 assuming a load spread at a conservative angle of 60 degrees from vertical.

The word “CRUSHED” is misspelled as “CRASHED” in Figure R403.4 (1). The spelling is corrected in this proposal.

Cost Impact: The code change proposal will not increase the cost of construction.

RB222-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R403.4T-RB-HELDERMAN.doc

RB223 – 13
R404.1.1

Proponent: Matthew L. Mlakar, Barrish Pelham & Associates, Inc., representing Structural Engineers Association of California

Revise as follows:

R404.1.1 Design of masonry foundation walls. Masonry foundation walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of ACI530/ASCE 5/TMS 402 ~~or NCMA TR68-A~~. When ACI530/ASCE 5/TMS 402~~, NCMA TR68-A~~ or the provisions of this section are used to design masonry foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

Reason: The referenced standard, NCMA TR-68-A-75 is out of date, and no longer available. Under ICC CP#28 policy section 3.6.3.2 the referenced standards shall be developed and maintained through a consensus process such as ASTM or ANSI. While NCMA TR68 was not developed through the ANSI consensus process during the adoption of the 2000 IRC, it was grandfathered into the code. However since the inception of the code, the referenced standard has not been maintained and is no longer in publication. The referenced standard should be removed at this time.

There are several other methods for the design of plain and reinforced masonry walls, so the removal of the standard will not prevent the use of masonry foundation walls.

Cost Impact: The proposal will not change the cost of construction.

RB223-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.1.1-RB-MLAKAR.doc

RB224 – 13
Table R404.1.1(1)

Proponent: Stephen Kerr, S.E., Josephson Werdowatz and Associates, Inc., representing self (skerr@jwa-se.com)

Revise as follows:

TABLE R404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[c] (feet)	PLAIN MASONRY[a] MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes[b]		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6 solid[d] or 8	6 solid[d] or 8	6 solid[d] or 8
	5	6 solid[d] or 8	8	8
6	4	6 solid[d] or 8	6 solid[d] or 8	6 solid[d] or 8
	5	6 solid[d] or 8	8	10
	6	8	10	12
7	4	6 solid[d] or 8	8	8
	5	6 solid[d] or 8	10	10
	6	10	12	10 solid[d]
	7	12	10 solid[d]	12 solid[d]
8	4	6 solid[d] or 8	6 solid[d] or 8	8
	5	6 solid[d] or 8	10	12
	6	10	12	12 solid[d]
	7	12	12 solid[d]	Footnote e
	8	10 ~~solid~~grout[d]	12 ~~solid~~ grout[d]	Footnote e
9	4	6 ~~solid~~grout[d] or 8 solid[d] or 12	6 ~~solid~~grout[d] or 8 solid[d]	8 grout[d] or 10 solid[d]
	5	~~8~~ 6 grout[d] or 10 solid[d]	~~10~~8 grout[d] or 12 solid[d]	~~12~~8 grout[d]
	6	~~10~~ 8 grout[d] or 12 solid[d]	~~12~~10 grout[d]	~~12 solid~~10 grout[d]
	7	~~12~~ 10 grout[d]	~~12 solid~~10 grout[d]	12 grout~~Footnote e~~
	8	~~12 solid~~10 grout[d]	12 grout~~Footnote e~~	Footnote e
	9	12 grout~~Footnote e~~	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.

a. Mortar shall be Type M or S and masonry shall be laid in running bond. Ungrouted hollow masonry units are permitted except where otherwise indicated.
b. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
c. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
d. Solid indicates solid masonry unit, grout indicates grouted hollow units~~ or solid masonry units~~.
e. Wall construction shall be in accordance with either Table R404.1.1(2), Table R404.1.1(3), Table 404.1.1(4), or a design shall be provided.

Reason: For plain masonry walls with a maximum height of 9 ft., all backfill depths, and 8ft. tall walls with 8ft. of backfill, the wall construction limitations of Table R404.1.1 (1) exceed the prescriptive requirements of TMS 402/ACI 530/ASCE 5 section 5.6.3 and Table 5.6.3.1. For these specific walls, when analyzed in accordance with TMS 402/ACI 530/ASCE 5, using the allowable flexural tensile stresses in Table 2.2.3.2, the values shown in Table R404.1.1 (1) cannot be justified. The proposed change is to make the values shown in Table R404.1.1 (1) compliant with the prescriptive and analytical requirements of TMS 402/ACI 530/ASCE 5.

It should be noted that in Table R404.1.1 (1) footnote d currently lumps solid grouted hollow units with solid masonry units. However, in both TMS 402/ACI 530/ASCE 5 Tables 5.6.3.1 and 2.2.3.2 the limitations of solid units are less than those of solid grouted hollow units. Depending on the type of mortar, the capacity from Table 2.2.3.2 for solid units is either 62% or 40% the capacity of solid grouted hollow units.

With this proposal the IRC table for plain masonry wall will meet the requirements found in the referenced standard.

Cost Impact: The cost of construction for 8ft and 9ft tall plain masonry walls will slightly increase. The cost increase will primarily only impact the 8ft and 9ft walls where solid masonry units are currently specified.

RB224-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.1.1(1)T-RB-KERR.doc

RB225 – 13

Table R404.1.1(1), Table R404.1.1(2), Table R404.1.1(3), Table R404.1.1(4) and Tables R404.1.2(2) thru R404.1.2(8)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (BajnaiC@chesterfield.gov)

Revise as follows:

TABLE R404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS[f]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[c] (feet)	PLAIN MASONRY[a] MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes[b]		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, ~~MH~~, ML-CL and inorganic CL

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d > 5 INCHES[a, c, f]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.1(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d > 6.75 INCHES[a, c, f]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d > 8.75 INCHES[a, c, f]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(2)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS[b, c, d, e, g, h, i, j, k]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(3)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH (203 mm) NOMINAL FLAT CONCRETE BASEMENT WALLS[b, c, d, e, f, h, l, j]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(4)
MINIMUM VERTICAL REINFORCEMENT FOR 10-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS[b, c, d, e, f, h, I, j]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(5)
MINIMUM VERTICAL WALL REINFORCEMENT FOR 6-INCH WAFFLE-GRID BASEMENT WALLS[b, c, d, e, f, h, I, j]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(6)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH WAFFLE-GRID BASEMENT WALLS[b, c, d, e, f, h, i, j, k]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(7)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH (152 mm) SCREEN-GRID BASEMENT WALLS[b, c, d, e, g, h, I, j]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

TABLE R404.1.2(8)
MINIMUM VERTICAL REINFORCEMENT FOR 6-, 8-, 10-INCH AND 12-INCH NOMINAL FLAT BASEMENT WALLS[b, c, d, e, f, h, i, k, n, o]

f. The use of this table shall be prohibited for soil classifications not shown.

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The table specifically says that the wall design is a function of a maximum of 60 psf hydraulic pressure. Soils with CH, MH, OL, OH and Pt have higher hydraulic pressures and therefore should not be allowed for backfilling purposes unless the wall is designed by a registered design professional.

Cost Impact: The code change proposal could increase the cost of construction.

RB225-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.1.1(1)T-RB-BAJNAI-BCAC.doc

RB226 – 13

R404.1.4.1, Table R404.1.1(2), Table R404.1.1(3), Table R404.1.1(4)

Proponent: Stephen Kerr, S.E., Josephson Werdowatz and Associates Inc., representing self (skerr@jwa-se.com)

Revise as follows:

R404.1.4.1 Masonry foundation walls. In ~~addition to the requirements of Table R404.1.1(1) plain masonry foundation walls in~~ buildings assigned to Seismic Design Category D_0, D_1 or D_2, as established in Table R301.2(1), masonry foundation walls shall comply with this section. In addition to the requirements of Table R404.1.1(1), plain masonry foundation walls shall comply with the following.

1. Wall height shall not exceed 8 feet (2438 mm).
2. Unbalanced backfill height shall not exceed 4 feet (1219 mm).
3. Minimum nominal thickness for plain masonry foundation walls shall be 8 inches (203 mm).
4. Masonry stem walls shall have a minimum vertical reinforcement of one No. ~~3~~ 4 (No. ~~10~~ 13) bar located a maximum of 4 feet (1219 mm) on center in grouted cells. Vertical reinforcement shall be tied to the horizontal reinforcement in the footings.

Foundation walls ~~in buildings assigned to Seismic Design Category D0, D1 or D2, as established in Table R301.2(1)~~, supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be constructed in accordance with Table R404.1.1(2), R404.1.1(3) or R404.1.1(4). Masonry foundation walls shall have two No. 4 (No. 13) horizontal bars located in the upper 12 inches (305 mm) of the wall.

TABLE R404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d ~~>~~ ≥ 5 INCHES[a, c]

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL[e]	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[b, c]		
		Soil classes and lateral soil load[d] (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less) 5 feet 6 feet 8 inches	#4 at 48 #4 at 48 #4 at 48	#4 at 48 #4 at 48 #5 at 48	#4 at 48 #4 at 48 #6 at 48
7 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 4 inches	#4 at 48 #4 at 48 #4 at 48 #5 at 48	#4 at 48 #4 at 48 #5 at 48 #6 at 48	#4 at 48 #4 at 48 #5 at 48 #6 at 40
8 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet	#4 at 48 #4 at 48 #4 at 48 #5 at 48 #5 at 48	#4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 48	#4 at 48 #4 at 48 #5 at 48 #6 at 40 #6 at 32
8 feet 8 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 8 inches	#4 at 48 #4 at 48 #4 at 48 #5 at 48 #6 at 48	#4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 32	#4 at 48 #5 at 48 #6 at 48 #6 at 40 #6 at 24

9 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 9 feet 4 inches	#4 at 48 #4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 40	#4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 40 #6 at 24	#4 at 48 #5 at 48 #6 at 48 #6 at 40 #6 at 24 #6 at 16
10 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 9 feet 10 feet	#4 at 48 #4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 40 #6 at 32	#4 at 48 #4 at 48 #5 at 48 #6 at 48 #6 at 32 #6 at 24 #6 at 16	#4 at 48 #5 at 48 #6 at 48 #6 at 32 #6 at 24 #6 at 16 #6 at 16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

a. Mortar shall be Type M or S and masonry shall be laid in running bond.

b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B, and C and 48 inches in Seismic Design Categories D_0, D_1 and D_2.

c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 5 inches.

d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.

e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.

TABLE R404.1.1(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d > ≥ 6.75 INCHES[a, c]

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL[e]	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[b, c]		
		Soil classes and later soil load[d] (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less) 5 feet 6 feet 8 inches	#4 at 56 #4 at 56 #4 at 56	#4 at 56 #4 at 56 #5 at 56	#4 at 56 #4 at 56 #5 at 56
7 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 4 inches	#4 at 56 #4 at 56 #4 at 56 #4 at 56	#4 at 56 #4 at 56 #4 at 56 #5 at 56	#4 at 56 #4 at 56 #5 at 56 #6 at 56
8 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet	#4 at 56 #4 at 56 #4 at 56 #4 at 56 #5 at 56	#4 at 56 #4 at 56 #4 at 56 #5 at 56 #6 at 56	#4 at 56 #4 at 56 #5 at 56 #6 at 56 #6 at 48
8 feet 8 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 8 inches	#4 at 56 #4 at 56 #4 at 56 #4 at 56 #5 at 56	#4 at 56 #4 at 56 #4 at 56 #5 at 56 #6 at 48	#4 at 56 #4 at 56 #5 at 56 #6 at 56 #6 at 32

9 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 9 feet 4 inches	#4 at 56 #4 at 56 #4 at 56 #4 at 56 #5 at 56 #6 at 56	#4 at 56 #4 at 56 #5 at 56 #5 at 56 #6 at 56 #6 at 40	#4 at 56 #4 at 56 #5 at 56 #6 at 56 #6 at 40 #6 at 24
10 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 9 feet 10 feet	#4 at 56 #4 at 56 #4 at 56 #5 at 56 #5 at 56 #6 at 56 #6 at 48	#4 at 56 #4 at 56 #5 at 56 #6 at 56 #6 at 48 #6 at 40 #6 at 32	#4 at 56 #4 at 56 #5 at 56 #6 at 48 #6 at 40 #6 at 24 #6 at 24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

a. Mortar shall be Type M or S and masonry shall be laid in running bond.

b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B, and C and 48 inches in Seismic Design Categories D_0, D_1 and D_2.

c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 6.75 inches.

d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.

e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.

TABLE R404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE d > ≥ 8.75 INCHES[a, c]

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL[e]	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES)[b, c]		
		Soil classes and lateral soil load[d] (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less) 5 feet 6 feet 8 inches	#4 at 72 #4 at 72 #4 at 72	#4 at 72 #4 at 72 #4 at 72	#4 at 72 #4 at 72 #5 at 72
7 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 4 inches	#4 at 72 #4 at 72 #4 at 72 #4 at 72	#4 at 72 #4 at 72 #4 at 72 #5 at 72	#4 at 72 #4 at 72 #5 at 72 #6 at 72
8 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet	#4 at 72 #4 at 72 #4 at 72 #4 at 72 #5 at 72	#4 at 72 #4 at 72 #4 at 72 #5 at 72 #6 at 72	#4 at 72 #4 at 72 #5 at 72 #6 at 72 #6 at 64
8 feet 8 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 8 inches	#4 at 72 #4 at 72 #4 at 72 #4 at 72 #5 at 72	#4 at 72 #4 at 72 #4 at 72 #5 at 72 #7 at 72	#4 at 72 #4 at 72 #5 at 72 #6 at 72 #6 at 48

9 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 56
	9 feet 4 inches	#6 at 72	#6 at 48	#6 at 40
10 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 48
	9 feet	#6 at 72	#6 at 56	#6 at 40
	10 feet	#6 at 64	#6 at 40	#6 at 32

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

a. Mortar shall be Type M or S and masonry shall be laid in running bond.

b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B, and C and 48 inches in Seismic Design Categories D_0, D_1 and D_2.

c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 inches.

d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.

e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab is permitted.

Reason: There are two parts to this proposal which are attempting to bring conformity within the IRC and with the requirements of the referenced standard.

The first sentence is changed so that the requirements for masonry and concrete foundation walls follow the same format. This should provide clarity and make it easier for the users of the IRC to utilize both materials. As part of this change, the repeated language referencing Table R301.2(1) in the last paragraph is redundant and removed.

The second item addressed by this proposal is the change from No. 3 bars to No. 4 bars for seismic reinforcement in SDC D_0, D_1 and D_2. TMS 402/ACI 530/ASCE 5, the adopted standard for masonry design, section 1.18.4.4.1 requires vertical reinforcement to be a minimum diameter of No. 4 bar spaced at a maximum of 48 inches. Footnote b in Tables R404.1.1(2), R404.1.1(3) and R404.1.1(4), are modified to reflect the maximum spacing limitation. In addition to the modification to footnote b, an editorial change is made to the titles, changing the greater than symbol (>) to a greater than or equal symbol (≥) in order to reflect the distance *d* as specified in footnote c. Under ICC CP#28 policy section 1.3.1 the provisions of all codes shall be consistent with one another so that conflicts between codes do not occur. The change in bar size and spacing will bring the minimum requirements of the referenced standard into the IRC.

Cost Impact: The code change proposal will slightly increase the cost of construction.

RB226-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.1.4.1-RB-KERR.doc

RB227 – 13
R403.3.4, R404.1.2.3.6.1

Proponent: Stephen Kerr, S.E., Josephson Werdowatz and Associates Inc., representing self (skerr@jwa.se.com)

Revise as follows:

R403.3.4 Termite protection ~~damage~~. The use of foam plastic in areas of "very heavy" termite infestation probability shall be in accordance with Section R318.4.

R404.1.2.3.6.1 Stay-in-place forms Stay-in-place concrete forms shall comply with this section.

1. Surface burning characteristics. The flame-spread index and smoke-developed index of forming material, other than foam plastic, left exposed on the interior shall comply with Section R302. The surface burning characteristics of foam plastic used in insulating concrete forms shall comply with Section R316.3.
2. Interior covering. Stay-in-place forms constructed of rigid foam plastic shall be protected on the interior of the building as required by Section R316. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives in addition to mechanical fasteners is permitted.
3. Exterior wall covering. Stay-in-place forms constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an *approved* exterior wall covering complying with this code. Exterior surfaces of other stay-in-place forming systems shall be protected in accordance with this code.
4. Termite protection ~~hazards~~. In areas where the probability of termite infestation ~~hazard of termite damage~~ is "very heavy" as indicated by Table R301.2(1) or ~~in accordance with~~ Figure R301.2(6), foam plastic insulation shall be permitted below *grade* on foundation walls in accordance with section R318.4.~~one of the following conditions:~~
   - ~~4.1. Where in addition to the requirements in Section R318.1, an *approved* method of protecting the foam plastic and structure from subterranean termite damage is provided.~~
   - ~~4.2. The structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure-preservative-treated wood.~~
   - ~~4.3. On the interior side of *basement* walls.~~
5. Flat ICF wall system forms shall conform to ASTM E 2634.

Reason: The three methods of foam plastic insulation protection listed in items 4.1, 4.2 and 4.3 are already covered in section R318.4. Instead of repeating these items, this proposal will place a pointer directly to section R318 Protection Against Subterranean Termites. If the methods of foam plastic protection change in the future, then the removal of the duplicative provisions may save a possible conflict in the code.

For reference: Item 4.1 is a repeat of the R318.4 exception 2
Item 4.2 is a repeat of the R318.4 exception 1
Item 4.3 is a repeat of the R318.4 exception 3

The wording of item 4 is also changed so that this section (R404.1.2.3.6.1) uses the same vernacular as the other sections in the code (R318.4). A similar change is proposed for section R403.3.4 changing "damage" to "protection". This will help bring uniformity to the IRC, improving the code.

Cost Impact: The code change proposal will not increase construction cost.

RB227-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.3.3.4-RB-KERR.doc

RB228 – 13
R202, R404.1.3, R404.4

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee (BajnaiC@chesterfield.gov)

Revise as follows:

R404.1.3 Design required. Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice when either of the following conditions exists:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top ~~or~~ and bottom.

R404.4 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of ~~24~~ 48 inches (610 mm) of unbalanced fill, or retaining walls exceeding 24 inches in height that resist lateral loads in addition to soil, shall be designed in accordance with accepted engineering practice to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning

Revise definition as follows:

WALL, RETAINING. A wall not laterally supported at the top, that resists only lateral ~~soil~~ load. ~~and other imposed loads.~~

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The International Code Council's Building Code Action Committee identified several items in Chapter 4, "Foundations", that are in conflict with other provisions of the code or lack clarity. This proposal specifically addresses conflicts and confusing language for when a design is required in Section R404.1.3 and retaining walls in Section R404.4.

Section R404.1.3 specifically requires that walls supporting more than 48 inches of unbalanced fill and not laterally supported require an engineered design. Section R404.4 addresses the same walls where they are not supported at the top but states that a design is required when the height of the unbalanced fill exceeds 24 inches. The two sections are in direct conflict. This proposal changes the trigger height in R404.4 to 48 inches to be consistent with other sections of the code.

In addition, this proposal clarifies, in R404.1.3 that the lateral support is required at the top **and** bottom. The definition of "WALL, RETAINING" is modified to be consistent with the intent of section R404.4. The type of wall addressed in R404.4 is a self-standing retaining wall that is not supported at the top and is laterally supported at the bottom against sliding and overturning by a factor of 1.5. This type of wall would typically be a site retaining wall where it is primarily resisting only lateral soil loads. The definition is modified to clarify that this type of wall is not intended to support structural loads. A similar wall that does support structural loads would be addressed by other sections.

Cost Impact: The code change will not increase the cost of construction.

RB228-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.4-RB-BAJNAI-BCAC.doc

RB229 – 13
R404.5.1, R404.5.2

Proponent: Paul Edward Helderman Jr., Codes and Standards Manager, Superior Walls of America, Ltd., representing Lancaster County Code Officials (LANCODE)

Revise as follows:

R404.5.1 Panel System Design. Precast concrete foundation wall~~s~~ panel systems shall be designed in accordance with accepted engineering practice. The design and manufacture of precast concrete foundation wall panels shall comply with the materials requirements of Section R402.3 or ACI 318. ~~The panel design drawings shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed in accordance with Section R106.~~

R404.5.2 Precast concrete foundation site specific construction documents ~~design drawings~~. Precast concrete foundation wall site specific construction documents ~~design drawings~~ shall be submitted to the building official and approved prior to installation. ~~Drawings~~ Site specific construction documents shall include, at a minimum, the information specified below:

1. Design loading as applicable
2. Footing design and material
3. Concentrated loads and their points of application
4. Soil bearing capacity
5. Maximum allowable total uniform load
6. Seismic design category
7. Basic wind speed

Reason: Previous language was vague and it confuses language about the engineered or pre-engineered "panel system designs", and "site specific construction documents" by using the term "panel design drawing." This language applies to any precast foundation system and is not proprietary to any one system. The term "panel design drawing" is ambiguous and is not defined in the code and needs to be removed from this paragraph. The reference to section R106 has been removed because the language is redundant and not necessary again in this section.

The new language is more clearly written and it more clearly separates these very different ideas of a panel system design and the construction documents and it removes the ambiguous term "panel design drawings." Section R404.5.1 as written in this proposal clearly deals only with the panel system design while section R404.5.2 describes only the site specific construction documents. Section R402.5.2 also still maintains the same minimum list of important items that shall be included in the construction documents to address structural and environmental loads for any precast concrete foundation system.

The panel system design still is required to be designed in accordance with accepted engineering practice.

Cost Impact: The code change proposal will not increase the cost of construction.

RB229-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R404.5.1-RB-HELDERMAN.doc

RB230 – 13
R405.1

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (152 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

> **Exception:** A drainage system is not required when the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

Reason: The purpose of this code change proposal is to add an exception to the requirement for filter fabric over gravel, crushed stone or perforated pipe drains. The Metropolitan Kansas Chapter of ICC introduced this requirement last cycle in proposal RB82-09/10 to provide additional direction for the installation of filter fabric. The intent was to improve the performance of foundation drains by insuring proper installation of the filter fabric, which keeps fines from clogging the drains. Since that time, it has come to light that some waterproofing manufacturers recommend against using filter fabric over the gravel or perforated pipe when the foundation drain is installed in "heavy" soils (certains clays and loams) as the fabric will inhibit water from entering the pipe. Therefore, some manufacturers will not warrant their product when a filter fabric is used in such conditions. This revision will provide an exception to the filter fabric requirement if the drain manufacturer's installation instructions recommend against using the filter fabric.

Cost Impact: The code change proposal will not increase the cost of construction.

RB230-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R405.1-RB-EHRLICH.doc

RB231 – 13
R405.1, R405.2.3

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below *grade*. Drainage tiles, gravel or crushed stone drains, perforated pipe or other *approved* systems or materials shall be installed at or below the area to be protected and shall discharge to daylight by gravity or ~~mechanical means into an *approved* drainage system~~ by a sump pump installed in accordance with the manufacturer's written installation instructions. Gravel or crushed stone drains shall extend at least 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (152 mm) above the top of the footing and be covered with an *approved* filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

> **Exception:** A drainage system is not required when the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

R405.2.3 Drainage system. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be at least 24 inches (610 mm) in diameter or 20 inches square (0.0129 m2)~~,~~ and shall extend at least 24 inches (610 mm) below the bottom of the *basement* floor ~~and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an *approved* sewer system or to daylight~~. The sump shall discharge to daylight by gravity or by a sump pump installed in accordance with the manufacturer's written installation instructions.

Reason: This is a prescriptive code and the code needs to spell out what the mechanical means are. Realistically, we are talking about a sump pump so why not just say that? A homeowner or contractor should not have to guess at the meaning of such a simple requirement. This proposal is consistent with the requirements found in IRC Chapter 33. The term "sump pump" is defined.

SUMP PUMP. A pump installed to empty a sump. These pumps are used for removing storm water only. The pump is selected for the specific head and volume of the load and is usually operated by level controllers.

Cost Impact: The code change proposal will not increase the cost of construction.

RB231-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R405.1-RB-DAVIDSON.doc

RB232 – 13
R406.1, R406.2

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R406.1 Concrete and masonry foundation ground water table level determination. In areas where a ground water table at or above the lowest proposed basement floor level or other severe soil water conditions are anticipated by soil studies or known conditions at nearby locations, the building official shall require a visual subsurface soil inspection to be performed at or before the time of foundation excavation to verify whether the existing ground water table is above a level one foot below the lowest proposed basement floor level or that other severe soil water conditions exists. The inspection may be performed by the building official or other person who is knowledgeable in making such determinations.

> **Exception:** A subsurface soil inspection as specified above shall not be required where waterproofing is provided in accordance with Section R406.3**.**

~~R406.1~~ **R406.2 Concrete and masonry foundation dampproofing.** Except where required by Section ~~R406.2~~ R406.3 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be dampproofed from the top of the footing to the finished *grade.* Masonry walls shall have not less than 3/8 inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

1. Bituminous coating.
2. Three pounds per square yard (1.63 kg/m^2) of acrylic modified cement.
3. One-eighth inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.
4. Any material permitted for waterproofing in Section R406.2.
5. Other appmved methods or materials.

> **Exception:** Parging of unit masonry walls is not required where a material is *approved* for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

~~R406.2~~ **R406.3 Concrete and masonry foundation waterproofing.** ~~In areas where a high water table or other severe soil-water conditions are known to exist~~Where the subsurface soil inspection required by Section R406.1 verifies that the ground water table is above a level 1 foot below the lowest proposed basement floor level or that other severe soil water conditions exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the top of the footing to the finished *grade.* Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing. Six-mil (0.15 mm) polyvinyl chloride.
3. Six-mil (0.15 mm) polyethylene.
4. Forty-mil (1 mm) polymer-modified asphalt.
5. Sixty-mil (1.5 mm) flexible polymer cement.
6. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
7. Sixty-mil (0.22 mm) solvent-free liquid-applied synthetic rubber.

> **Exception:** Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to type C of ASTM D

449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Reason: The purpose of this code change is to amend the requirements for determining if waterproofing of concrete and masonry foundation walls is required. In many areas of the country, potential damp/wet basements are a significant problem that is not adequately addressed during the construction process. The existing language is vague and rarely results in any determination by the building official as to whether a high ground water table exists. Additionally, soils studies such as those published by the USDA are incorrectly used as the justification for requiring waterproofing despite the reference in their use that, "interpretations based on soil surveys are rarely suitable for such onsite evaluations as home sites without further evaluations at the specific site." This change would result in the use of soil studies, whether USDA- or locally-prepared, or known conditions on nearby/adjacent properties to properly serve as the basis for whether a visual subsurface soil inspection is warranted. This inspection, conducted either by the building official, building department inspector or other qualified personnel, will be used to determine if waterproofing needs to be provided for those dwellings where the builder does not already provide it as a matter of course.

This change would increase the cost of construction where a high ground water table or other severe soil water condition is anticipated by either requiring the inspection or requiring waterproofing if it was not already part of the construction. It may reduce the cost of construction if the visual inspection determines waterproofing is not required for a site where the USDA or other large-scale soil survey would otherwise suggest that it is.

Cost Impact: The code change proposal may increase the cost of construction.

RB232-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R406.1 (NEW)-RB-EHRLICH.doc

RB233 – 13
R406.1, R406.2

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R406.1 Concrete and masonry foundation dampproofing. Except where required by Section R406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be dampproofed from the <u>higher of (a) the</u> top of the footing <u>or (b) 6 inches below the top of the basement floor,</u> to the finished *grade.* Masonry walls shall have not less than 3/8 inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

1. Bituminous coating.
2. Three pounds per square yard (1.63 kg/m^2) of acrylic modified cement.
3. One-eighth inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.
4. Any material permitted for waterproofing in Section R406.2.
5. Other appmved methods or materials.

   Exception: Parging of unit masonry walls is not required where a material is *approved* for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the <u>higher of (a) the</u> top of the footing <u>or (b) 6 inches below the top of the basement floor,</u> to the finished *grade.* Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil (0.22 mm) solvent-free liquid-applied synthetic rubber.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Reason: The purpose of this code change is to amend the requirements for dampproofing and waterproofing of concrete and masonry foundation walls. The change eliminates unnecessary dampproofing or waterproofing on wall areas that do not affect the livability of interior spaces and floors below grade. These wall areas include areas where the footings area stepped down below the basement floor level for required frost protection depth or to place footings on undisturbed natural soils or engineered fills. This will reduce the cost of construction where the footings described in the reason statement are present. The 6 inch cut-off comes from the IBC Section 1805.1.3 requirements for a ground water control system.

It is noted that this code change does not prohibit a builder from providing waterproofing all the way down to the top of footings that are lower than 6" below the basement floor level if desired due to ease of installation of drainage boards or other panel waterproofing products, or if required by the manufacturer's installation instructions or details for a particular waterproofing product.

Cost Impact: The code change proposal will not increase the cost of construction.

RB233-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R406.1-RB-EHRLICH.doc

RB234 – 13
R501.3

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

~~**R501.3**~~ **R302.13** **Fire protection of floors.** Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies can be unprotected when complying with the following:
   3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story
   3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance

Reason: During the last cycle the IRC Committee endorsed a move to place all fire resistive requirements in the same section. This proposal simply relocates existing text in accordance with that goal.

Cost Impact: The code change proposal will not increase the cost of construction.

RB234-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3 #1-RB-DAVIDSON.doc

RB235 – 13
R501.3

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R501.3 Fire protection of floors. Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member. <u>Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaries, wires, speakers, drainage, piping, and similar openings or penetrations shall be permitted.</u>

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies can be unprotected when complying with the following:
   3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story
   3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.

Reason: There needs to be direction in the code relative to common openings and penetrations in these membranes. Where these membranes protect the underside of floors exposed to the weather, openings for drainage must be provided.

Cost Impact: The code change proposal will not increase the cost of construction.

RB235-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3 #3-RB-DAVIDSON.doc

RB236 – 13
R501.3

Proponent: Jeffrey M. Hugo, CBO, National Fire Sprinkler Association (hugo@nfsa.org)

Revise as follows:

R501.3 Fire protection of floors. Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member.

Exceptions:

1. Floor assemblies ~~located directly over a space~~ in dwellings protected throughout by an automatic sprinkler system in accordance with Section P2904~~,~~ or NFPA13D~~,~~. ~~or other approved equivalent sprinkler system.~~
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of floor assemblies can be unprotected when complying with the following:
   3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story
   3.2 Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.

Reason: In several areas where the IRC is adopted, Section 501.3 Exception #1 "…or other approved equivalent sprinkler system." is interpreted to permit the dwelling unit to only have a partial residential sprinkler "system" installed in the unprotected ceiling space, i.e. only fire sprinklers in the basement ceiling. This was not the intent of the authors of this text in the previous code cycle.

A residential fire sprinkler system designed according to NFPA 13D and/or P2904 is considered "sprinklered throughout" and does not have criteria or rules for partial systems. When a partial system is installed, it would violate not only the standards for installation, but the very requirement that mandated the system in the first place, Exception #1 of Section 501.3.

Cost Impact: The code change proposal will not increase the cost of construction.

RB236-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3-RB-HUGO.doc

RB237 – 13
R501.3

Proponent: Sean DeCrane, Cleveland Division of Fire, representing Cleveland Division of Fire/ International Association of Fire Fighters (rovloc93@aol.com)

Revise as follows:

R501.3 Fire protection of floors. Floor assemblies, not required elsewhere in this code to be fire-resistant rated, shall be provided with a ½-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA 13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.
3. Portions of the floor assembly can be unprotected when complying with the following:
   3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story.
   3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, ~~or other approved floor assemblies demonstrating equivalent fire performance.~~

Reason: This author was the original proponent of the current language in the IRC and appreciates the assistance of the representatives from NAHB and the American Wood Council who worked hard to place this language in the code providing additional protection to the responding fire fighters and the residents occupying these occupancies.

Since passage of this language it has become apparent there is cause for concern in portions of the language. One serious concern that has been demonstrated through additional testing at Underwriters Laboratories involves the language in Exception 4 permitting the use of *other approved floor assemblies demonstrating equivalent fire performance*. While this language was placed in the body of the code its intent was to allow the equivalency for a protected floor assembly. The language in Exception 4 allows the equivalency to an unprotected floor assembly.

We also want to ask the question, demonstrating the equivalent performance by what Standard? If it is to the ASTM E 119 Standard the ICC-ES has already permitted a deviation from a true E 119 test. In recent hearings, despite testimony to the contrary and evidence that the decision was based on misrepresented numbers the ICC –ES permits the reduction of the applied load to 50% of the design load, submitted as AC 14. A proponent is also not required to test a full assembly; simply testing two joists would be permitted.

There is a great concern on the reduction of the applied load. Further testing completed at Underwriters Laboratories has demonstrated the importance the applied load and the misrepresentation of true performance under fire conditions. I have provided a link at the bottom where the UL Tests reports can be accessed in detail.

The results of the original UL furnace testing on the performance of lightweight floor systems was instrumental in demonstrating the concern on the lack of performance in fire conditions of specific engineered products. Just a short recap, with a modified load of 40 lb/ft² on two sides of the floor system and two 300 pound fire fighter mannequins' tests results demonstrated:

- Unprotected 2 x 10 Dimensional Lumber collapsed at 18:45.
- Unprotected 16" I-Joists collapsed at 6:03.
- The use of ½" gypsum wallboard as protection allowed the 2 x 10 Dimensional to collapse at 44:45.
- The use of ½" gypsum wallboard as protection allowed the 16" I-Joist to collapse at 26:45.

A substantial improvement was realized simply by adding the gypsum board.

Let us now review recent test results conducted in the ASTM E 119 Standard test furnace. This report was issued in 2011 prior to the ICC-ES hearing. In the follow up tests there was an attempt to replicate test results for consistency plus there had been discussions on how some of the floor systems were not tested to a true E 119 test standard of 100% design load. The question would be; how would the applied load impact the performance of the floor? As you can clearly realize below, the test load has a direct impact on time performance.

- A 16" I-Joist floor assembly unprotected with a full design load collapsed at 2:02, a full four minutes earlier than the previous test to a modified load;

- A 2 x 10 dimensional lumber floor assembly with a full design load collapsed at 7:00, a full eleven minute difference to a modified load;
- A potential "equivalent" floor protection system (Intumescent paint) was tested to a modified load (40 lb/ft² on two sides and fire fighters in the middle) collapsed at 8:40. We saw a reduction in performance with the full load applied to the 2 x 10 dimensional lumber. What is the true performance when subjected to a full load? We will not know as the equivalency requirements allow the reduce test parameters including small samplings. (Test report language and timeline are listed below).

"Experiment 5 examined an engineered I-joist floor assembly with a spray applied fire retardant coating and the modified loading configuration (Figure 61 and Figure 62). The floor assembly failed at 8:40 after ignition. Observations made during the experiment of the exposed and unexposed sides of the floor assembly are detailed in Table 17. The average furnace temperature during the experiment followed the standard curve closely until approximately 6 minutes when the floor system was involved in flames (Figure 63).

The furnace pressure and oxygen concentration measured in the furnace are presented in Figure 64 and Figure 65 respectively. The pressure remained between -0.3 in. w.c. and 0.6 in. w.c. but fluctuated around 0 for most of the experiment. The oxygen concentration fluctuated and then decreased to less than 5 % by 7 minutes and remained at or below that concentration until collapse." [1]See UL Report Fire Service Collapse Hazard Floor Furnace Experiments.

Exp. Time, Min:Sec	Surface Observations
1:15	Crackling could be heard and smoke was present at West edge.
2:00	More frequent crackling could be heard.
2:00	Too dark to seen in furnace.
3:10	Crackling and smoke ceased.
3:45	Crackling and smoke started again.
4:00	Material on joists began to lighten in color and started to crack.
4:15	More intense smoke and crackling was present.
4:45	Significant flaming could be seen from first two joist bays on the north end of the assembly.
5:10	Crackling continued.
6:00	Smoke from subfloor joints was present.
6:00	Joist orange in color and looked like charring wood.
6:45	Significant flaming over entire exposed surface.
7:00	Kneeling mannequin began to vibrate vertically.
7:30	Entire assembly began to deflect into the furnace.
7:30	Vision obscured by fall off material circulating throughout the furnace.
8:10	Larger vertical vibrations could be seen on both mannequins.
8:15	Noticeable deflection could be seen at the centerline of the assembly.
8:30	Joist webs started to burn through.
8:40	Structural failure.

In recent years the fire service has become concerned on the performance of "modern" lumber and the use of engineered trees to produce lumber in a shorter time frame. While the elimination of this code language does not address this concern it does require manufacturers to produce products that will be tested and compared to a protected floor assembly as opposed to an unprotected floor. There is currently a proposal to ICC-ES, at the time of this submission, AC 450, to consider the approval of the use of an intumescent product, eerily similar to the test parameters of Test #5. The previous approval of AC 14 now allows the reduced floor assembly and test load in the comparable.

As we have demonstrated the concern in allowing reduced test parameters to address equivalencies in structural floor systems. We believe we should be using equivalencies to meet protected floor systems. The other question we would like to present would be what is the expected equivalent performance? Is it the 2 x 10 dimensional lumber's performance to a 100% design load? We saw a test performance of seven minutes, very close to the performance time of lightweight systems in the original tests that moved the ICC membership to require the protection of these floor systems. This is a question yet to be truly answered by the current language and that is why the membership must remove the equivalency language in Exception 4.

Traditionally the International Residential Code has been a prescriptive code. While the intent of this code language was not to promote gypsum board specifically we must ensure any substitute for a known consistent protection feature be held to a comparative Standard of performance to ensure consistency and safety.
http://www.ul.com/global/documents/offerings/industries/buildingmaterials/fireservice/basementfires/2009%20NIST%20ARRA%20Appendix%20B%20-%20Fire%20Service%20Collapse%20Hazard%20Floor%20Furnace%20Experiments.pdf

1. Underwriters Laboratories, http://www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/smokeparticulates/

Cost Impact: This proposal may or may not increase costs depending on cost of equivalent product.

RB237-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3-RB-DECRANE.doc

RB238 – 13
R501.3

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R501.3 Fire protection of floors. ~~Floor~~ All floor assemblies~~, not required elsewhere in this code to be fire-resistance rated,~~ shall be provided with a ½-inch (12.7 mm) gypsum wallboard membrane~~,~~ or a ⅝-inch (16 mm) wood structural panel membrane~~, or equivalent~~ on the underside of the floor framing members. Walls, columns, or other members supporting assemblies required to be protected by this section shall be provided protection equivalent to that provided for the floor.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section ~~P2904, NFPA13D, or other approved equivalent sprinkler system~~ R313.
~~2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.~~
2. Floor assemblies required to be protected by R302.3, R302.6, or R302.7.
3. Portions of floor assemblies can be unprotected when complying with any of the following:
   3.1. ~~The aggregate area of the unprotected portions shall not exceed 80 square feet per story.~~ A maximum of 150 square feet of floor assembly per story may be unprotected. The unprotected assembly must be separated from the protected assembly by a layer of ½-inch gypsum board, ⅝ structural panel sheathing, or solid sawn lumber blocking applied to the perimeter of the unprotected area.
   ~~3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.~~
   3.2 Floor assemblies or landings where the underfloor space is enclosed on all sides and there is not provided a means to access such underfloor space.
   3.3 Floor assemblies where the underfloor space is exposed to the exterior or is not within surrounding foundation walls of the dwelling such as decks, porches, or dwellings constructed on piers
   3.4 Floor assemblies of additions to existing dwellings.
   3.5 Floor assemblies in detached accessory structures.
~~4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.~~

Reason: This revision involves a little language cleanup for clarity, readability, and reasonability. The first paragraph has largely editorial revisions. Part of the first sentence has been moved to the "exceptions". A new sentence has been added that addresses protection of structural members supporting the fire protected floor assembly. There are numerous examples in the IRC consistent with this language including protection of walls in a garage when the ceiling is part of the garage/dwelling separation.

In exception #1, the reference to other approved systems is deleted. If other systems are known to exist, they should be noted. Otherwise the code already allows consideration of equivalencies.

The second exception is proposed for deletion. Crawl spaces aren't required to have sprinkler protection. Crawl spaces will be used for storage if there is access provided. Let's not kid ourselves. Let's simplify the process because you cannot plan check or inspect "not intended for". The builder/owner can decide to either add sprinkler protection, provide the membrane protection, or seal the area off completely.

A new second exception is added that specifically identifies the three locations in the code where floor assemblies must have a fire-resistant membrane. No more guessing.

The first two subsections of the third exception are combined into one exception as both parts must be used together to make sense. As currently written, one can take them as two different exceptions because that is how it is written. This can cause confusion and a lack of uniformity. Furthermore, the exception has been amended to increase the size of the unprotected space from 80 square feet to 150 square feet. Furnace/mechanical/laundry rooms are the most problematic places for compliance what with pipes, ducts, vents, etc., making a ceiling installation difficult. Most of these spaces exceed 80 square feet (which is an arbitrary limit) so again we are faced with boxing out small portions of the ceiling to meet the 80 square foot limit. 150 square feet is a more workable size. The exception is further revised to address the perimeter separation. The term “fire blocking” is inappropriate for this application as many methods do not lend themselves to this environment and fire blocking by definition is intended for concealed spaces.

Additional means to allow unprotected portions of floor assemblies are addressed with several new items.
An exception is provided for landings and floor assemblies that are completely enclosed and not provided with a means to access such space thereby preventing fires from spreading to those areas.

An exception is provided for floors open to the exterior (decks, porches). It should be readily identifiable to the fire service if the space under such areas is on fire.

An exception is added for additions to existing dwellings. It makes little sense to require the basement ceiling of a 12 X 12 addition to an existing 2000 square foot house to be protected when the rest of the ceiling is unprotected. The rule has to have some semblance of reasonableness. Homes that have sprinkler protection will already be covered.

The last exception excludes protection for floors for detached accessory structures. This might be an attic storage space in a detached garage or the second floor of a small children’s play house. There should be no need for entry of the fire service into these areas as they are not habitable space.

Exception number four is proposed for deletion for several reasons. New homes and additions are occasionally constructed with a mix of different size floor framing members. This can result in a patchwork of floor systems that require protection mixed with some that don’t. No one believes that such a system serves any purpose.

And, recent studies show there is little difference in the performance of various structural floor systems in fire conditions. We need to do what many folks said at the hearings when this proposal was approved and “level the playing field”, “protect them all”. Is a floor of 2X8’s 12” o.c. less resistant to collapse from a fire than 2X10’s at 24” o.c.? I doubt it. Let’s eliminate the confusion and “level the playing field”. Protect them all.

Cost Impact: The code change proposal will not increase the cost of construction.

RB238-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3 #2-RB-DAVIDSON.doc

RB239 – 13
R501.3

Proponent: Jonathan Humble, AIA, NCARB, LEED-AP BD&C, American Iron and Steel Institute (Jhumble@steel.org)

Revise as follows:

~~R501.3~~ R302.2 Fire protection of floors. Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum ~~wall~~board membrane, ~~5/8-inch (16 mm) wood structural panel membrane~~, or equivalent on the underside of the floor framing member.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA13D, or other approved equivalent sprinkler system.

2. Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.

3. Portions of floor assemblies can be unprotected when complying with the following:

   3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story

   3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.

4. ~~Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.~~

Reason: We are proposing to make two modifications:

- Relocate this provision to Section R302 "Fire-Resistant Construction"
- Modify the provisions to delete the exposed wood allowances

Relocation:
We propose to move this provision into Section R302 "Fire-Resistant Construction" since the topic is directly related to that section. Our recommendation is that this section be adjacent to Section 302.1 "Exterior Walls" since both sections are related to the basic constructions of a dwelling. As a result of this action we also propose that the remaining sections be renumbered.

Conflict:
We know from experience that there are three basic components necessary to supporting fire; that of oxygen, heat, and fuel. In the case of Section 501.3 it is permitting a fuel source to be part of the fire resistance requirements, that of exposed wood panels and wood framing. We find this counterintuitive, and not consistent, to the other fire-resistance provisions of the International Residential Code.

We have also made an editorial change to the charging paragraph by modifying the reference "gypsum wallboard" to "gypsum board" to be consistent with the IRC and family of I-codes.

Modifications:
We propose to remove 5/8 inch wood structural panel provisions from this section as we do not believe they should be considered equivalent to the other provisions. We submit that combustibility, flame spread, and contributions to accelerated flashover should also be considered when assessing fire resistance.

In regard to Exception #4, we challenge the basis for this type of assembly to be considered an exception. If we examine the UL fire tests (See bibliography, Table 42, Collapse Time Table) we find that two (2) floor assemblies were designed with unprotected dimensional lumber of nominal 2x12 joists and that they failed at 11:09 min (with max. ventilation) and 12:45 min (with sequenced ventilation). And further, we found that the exposed framing also contributes to combustibility, flame spread and accelerated flashover. This was reported in the "review and comment" section of the report, which stated:

> *"…Unprotected wood assemblies, both dimensional and engineered components, upon combustion contributed significant fuel loads to the experimental fires raising corresponding temperatures above the standardized ASTM E119 time temperature curve…."[2]*

This exception #4 is approximately 4 minutes less than the time assigned to an assembly containing 1/2 inch thick regular gypsum board in the component additive method and based on the other UL tests (e.g. 15 minutes) which cited in multiple locations that the *"…addition of a ½ inch thick gypsum board ceiling as a protective layer increased the fire resistance time…"* [2] Therefore, we submit that Exception #4 does not represent an equivalent, nor should it represent an exception, based on the fact that the time for failure is less than the assembly with a gypsum board membrane.

In addition, the allowance for exposed wood is contrary to the current provisions of Section R302 "Fire-resistant Construction." The current cases where a separation is defined we see that Section R302.6 "Dwelling/Garage Fire Separation," and Section R302.7 "Under-stair Protection," provisions do not allow exposed wood for anticipated circumstances that are similar to that of the basement conditions of current Section R501.3. Gypsum board on the other hand consists of a non-combustible core primarily of gypsum with a paper surfacing. As a result we would submit that it is inappropriate for wood to be exposed in conditions where the intent of separations are required to protect the occupants.

One may say that Section R302.5.1 "Opening Protection" allows exposed wood in the form of "solid wood doors," but that is permitted on the theory that solid wood (Like timber construction) will char due to its mass. We would submit that the 5/8-inch (16 mm) wood structural panel membrane does not represent an equivalency to a 1-3/8 inch thick solid wood door. In regard to the Exception #4 for exposed 2 x 10 nominal wood framing, we would again reiterate that when evaluating fire resistance more than just charring needs to be considered.

Bibliography:

[1] NFPA, *A Reporters Guide to Fire and the NFPA*, National Fire Protection Association, Quincy, MA, 2012. The guide can be found on the web at:
http://www.nfpa.org/categoryList.asp?categoryID=1327&URL=Press%20Room/A%20Reporter's%20Guide%20to%20Fire%20and%20the%20NFPA&cookie%5Ftest=1

[2] UL, *Full-Scale Floor System Field and Laboratory Fire Experiments*, Underwriters Laboratories, Northbrook, IL, January 2012. Report can be found on the web at:
http://www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/basementfires/

Cost Impact: The code change proposal will not increase the cost of construction.

RB239-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3-RB-HUMBLE.doc

RB240 – 13
R501.3

Proponent: Thomas Peterson, Box Elder County, representing Utah Chapter of ICC (tpeterson@boxeldercounty.org)

Delete without substitution as follows:

~~**R501.3 Fire protection of floors.** Floor assemblies, not required elsewhere in this code to be fire-resistance rated, shall be provided with a $^{1}/_{2}$-inch (12.7 mm) gypsum wallboard membrane, $^{5}/_{8}$-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member.~~

~~**Exceptions:**~~

1. ~~Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section P2904, NFPA13D, or other approved equivalent sprinkler system.~~
2. ~~Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.~~
3. ~~Portions of floor assemblies can be unprotected when complying with the following:~~
   - ~~3.1. The aggregate area of the unprotected portions shall not exceed 80 square feet per story~~
   - ~~3.2. Fire blocking in accordance with Section R302.11.1 shall be installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.~~
4. ~~Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.~~

Reason: The code reference is not needed as one of the exceptions of requiring the fire protection of floors is that an NFPA 13D system be installed. NFPA 13D systems are required by Section R313 of this code in all structures. Section R501.3 is not applicable and should be removed from the code to prevent confusion of what is required.

Cost Impact: This code change proposal will not increase the cost of construction.

RB240-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R501.3-RB-PETERSON.doc

RB241 – 13
R502.1 (NEW), R502.1.1, R502.1.1.1, R502.1.2, R502.2.2 (NEW)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R502.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

~~**R502.1**~~ **R502.1.1** ~~**Identification.**~~ **Sawn Lumber.** ~~Load-bearing dimension~~ Sawn lumber ~~for joists, beams and girders~~ shall be identified by a grade *mark* of ~~a~~ an accredited lumber grading or inspection agency ~~that has been *approved* by~~ and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade *mark*, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

~~**R502.1.1**~~ **R502.1.1.1 Preservative-treated lumber.** Preservative treated dimension lumber shall also be identified as required by Section R317.2.

~~**R502.1.2 Blocking and subflooring.** Blocking shall be a minimum of utility grade lumber. Subflooring may be a minimum of utility grade lumber or No. 4 common grade boards.~~

R502.2.2 Blocking and subflooring. Blocking for fastening panel edges or fixures shall be a minimum of utility grade lumber. Subflooring shall be a minimum of utility grade lumber or No. 4 common grade boards. Fireblocking shall be of any grade lumber.

Reason: The change is intended to clarify the process by which lumber design values are certified and recognized in the code. The current process, which has been used since 1970, relies on the internationally recognized U.S. Department of Commerce Voluntary Product Standard PS20. Because the current format of the section can be incorrectly interpreted to place a number of wood products under the identification requirements of PS20, a new format is proposed that clearly states this standard is only for sawn lumber. The format proposed is nearly identical to what is used in Section 2302 of the International Building Code. Wood products other than sawn lumber have unique manufacturing standards, design value development, and quality control criteria. This new format clarifies that these other wood products must comply with specific product standards.

Cost Impact: This code change proposal will not increase the cost of construction.

RB241-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1 (NEW)-RB-PITTS.doc

RB242 – 13
R502.1.6, R602.1.3, R802.1.5

Proponent: Rob Pickett, RobPickett & Associates, LLC, representing Log Homes Council (robpickett@vermontel.net)

Revise as follows:

R502.1.6 Structural log members. ~~Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted to be accepted.~~ Structural log members shall comply with the provisions of ICC-400.

Revise as follows:

R602.1.3 Structural log members. ~~Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted to be accepted.~~ Structural log members shall comply with the provisions of ICC-400.

Revise as follows:

R802.1.5 Structural log members. ~~Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted to be accepted.~~ Structural log members shall comply with the provisions of ICC-400.

Reason: The intent of this section is maintained and improved by referring to ICC400 where Section 302.2.1 covers stress grading of logs. ICC400 Section 302.2 provides additional information regarding moisture content, design stress values, section properties and presents design stress value tables for logs per visual stress grading rules written by approved log grading agencies in accordance with ASTM D 3957.

Cost Impact: The code change proposal will not increase the cost of construction.

RB242-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1.6-RB-PICKETT.doc

RB243 – 13
R202 (NEW), R502.1.8 (NEW), R502.8.2, R602.1.5 (NEW), R802.1.6 (NEW), R802.7.2, Chapter 44

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R502.1.8 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R502.8.2 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members, or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a *registered design professional*.

Revise as follows:

R602.1.5 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

Revise as follows:

R802.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R802.7.2 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members, or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such *alterations* are specifically considered in the design of the member by a *registered design professional*.

Add new definition as follows:

CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

Add new standard to Chapter 44 as follows:

APA

ANSI/APA PRG 320-2012 Standard for Performance-Rated Cross-Laminated Timber

Reason: During the Group A hearings, code changes S250-12 and G142-12 were approved as submitted which added cross-laminated timber (CLT) methodology to the IBC. Although it's envisioned that the primary use for CLT construction will be for non-residential construction, it's currently being used in some residential applications. This proposal recognizes CLT by defining it and mandates compliance with the CLT product standard. Like some of the other engineered wood products that are recognized in the IRC, such as structural composite lumber, details of use aren't provided.

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ANSI/APA PRG 320 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB243-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1.8 (NEW) #1-RB-PITTS.doc

RB244 – 13
R202 (NEW), R502.1.8 (NEW), R602.1.5 (NEW), R802.1.7 (NEW), Chapter 44

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Add new text as follows:

R502.1.8 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new text as follows:

R602.1.5 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new text as follows:

R802.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new definition as follows:

ENGINEERED WOOD RIM BOARD. A full-depth structural composite lumber, wood structural panel, structural glued laminated timber, or pre-fabricated wood I-joist member designed to transfer horizontal (shear) and vertical (compression) loads, provide attachment for diaphragm sheathing, siding and exterior deck ledgers, and provide lateral support at the ends of floor or roof joists or rafters.

Add new standards to Chapter 44 as follows:

ANSI

ANSI/APA PRR 410-2011 Standard for Performance-Rated Engineered Wood Rim Boards

ASTM

ASTM D 7672-2012 Standard Specifications for Evaluating Structural Capacities of Rim Board Products and Assemblies

Reason: This proposal is intended for consistency with the IBC. S248-12 was approved which added this definition and text to the IBC. Engineered rim board is a key structural element in many engineered wood floor applications where both structural load path through the perimeter member and dimensional change compatibility are design considerations. Two new consensus standards address products intended for engineered wood rim board applications. While both ANSI/APA PRR 410 and ASTM D7672 standards address the fundamental requirements for testing and evaluation of engineered rim board, PRR 410 also includes performance categories for engineered wood products used in engineered rim board applications. Under PRR 410, products are assigned a grade based on performance category (e.g. categories based on structural capacity) and will bear a mark in accordance with the grade. In contrast, ASTM D7672 is applicable for determination of product specific rim board performance (i.e. structural capacities) for engineered wood products that may be recognized in manufacturer's literature or product evaluation reports.

Cost Impact: The code change will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ANSI/APA PRR 410 and ASTM D 7672 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB244-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1.8 (NEW) #2-RB-PITTS.doc

RB245 – 13
R202 (NEW), R502.1.8 (NEW), Chapter 44

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Add new text as follows:

R502.1.8 Cross-laminated timber. Cross-laminated timber (CLT) shall be manufactured and identified as required by ANSI/APA PRG 320.

Add new definition as follows:

CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of at least three layers of solid-sawn lumber or *structural composite lumber* where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

Add new standard to Chapter 44 as follows:

APA

ANSI/APA-PRG 320-2012 Standard for Performance-Rated Cross-Laminated Timbers

Reason: This change is essentially identical to item S250-12/13 adopted in Portland in the October Final Action Hearing.

While new to North America, cross-laminated timber (CLT) construction is a well established building system in Europe. This system is made up of solid wood slabs up to 45-feet long, over 9-feet high, and 10-inches thick. Cross-laminated like plywood from lumber planks, CLT has a minimum of 3 and as many as 7 layers. (Think plywood on a grand scale!)

These timbers come in a number of configurations suitable for wall, roof and/or floor applications. Due to their makeup, these wall-size timbers have the fire resistance of heavy timber construction as well as exceptional in plane (shear walls and bracing) and out of plane (wind) strength and stiffness. Having essentially no inside cavities and being solid throughout, air infiltration and inner-wall condensation are essentially eliminated. Being wall sized, these timbers came to the jobsite with all openings pre-cut and erection times are just a fraction of those for conventional construction.

A National Design Specification (NDS) supplement is currently under development and several test projects are underway in North America. In parallel with the research and development work being conducted in North America, the APA initiated the development of an ANSI standard in 2010. The goal is to have a recognized national/consensus standard in place in the building codes when design information and fabrication capability comes on line.

Additional information is available at:
http://www.woodworks.org/files/PDF/Presentations/SE-Nov-2010/Mohammad.pdf

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ANSI/APA-PRG 320 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB245-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1.8 (NEW)-RB-KEITH.doc

RB246 – 13
R202 (NEW), R502.1.9 (NEW), R602.1.6 (NEW), R802.1.8 (NEW), Chapter 44

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Add new text as follows:

R502.1.9 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new text as follows:

R602.1.6 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new text as follows:

R802.1.8 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D 7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D 7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

Add new definition as follows:

ENGINEERED WOOD RIM BOARD. A full-depth structural composite lumber, wood structural panel, structural glued laminated timber, or pre-fabricated wood I-joist member designed to transfer horizontal (shear) and vertical (compression) loads, provide attachment for diaphragm sheathing, siding and exterior deck ledgers, and provide lateral support at the ends of floor or roof joists or rafters.

Add new standards to Chapter 44 as follows:

APA

ANSI/APA PRR 410-2011 Standard for Performance Rated Engineered Wood Rim Boards

ASTM

ASTM D 7672-2012 Standard for Specification for Evaluating Structural Capacities of Rim Board Products and Assemblies.

Reason: This change is essentially identical to item S248-12/13 adopted in Portland in the October Final Action Hearing.

With the acceptance of engineered wood floor joists and beams in to modern building systems it had become increasingly important to match the physical properties with respect to moisture of the various wood systems used in parallel load paths. The rim joist is a good example, in that a solid sawn lumber rim joist should not be used in conjunction with engineered wood floor joists. The engineered-wood floor joists are often dry when they are placed in the building system and subject to very little shrinkage as they reach equilibrium moisture content with the completed building system. As such it is imperative that a rim-joist product with similar physical properties be used in conjunction with the engineered-wood floor joists.

Lumber is normally delivered to the jobsite at a moisture content of from 16 to 18 percent. As the lumber rim joist dries out and reaches equilibrium of 8 – 10 percent moisture content, it can shrink by as much as ½ inch. As the lumber rim joist shrinks away from the top of the engineered-wood framing all of the vertical loads carried by the rim joist (up to 2000 plf) are effectively redistributed to the floor joists and other framing members, not designed for the extra load. For this reason, as well as the resource utilization advantages of engineered-wood products, engineered-wood rim joists have been produced and sold for almost as long as other popular engineered-wood products such as I-joists. Up until now each of these rim joist products has been manufactured to proprietary standards or no standards at all. The building official was left without any guidance from the building code on the acceptability of these very common produces.

The new ANSI/APA rim board standard or the new ASTM rim board standards are consensus-based standards that have been developed by industry to correct this discrepancy and to eliminate the necessity of the engineered wood industry to continually maintain a large number of proprietary product standards.

Voting to accept these consensus based standards will make the building officials' job easier, provide for better and safer structures at a lower cost to the consumer, as well as reducing the regulatory burden for the manufacturers.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ANSI/APA PRR 410 and ASTM D 7672 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB246-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.1.9 (NEW)-RB-KEITH.doc

RB247 – 13
Table R502.3.3(1), Table R502.3.3(2)

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (ehrlich@nahb.org)

Revise as follows:

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLY[a, b, c, f, g, h]
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)

Member & Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.)[d, e]											
	Ground Snow Load											
	≤ 20 psf			30 psf			50 psf			70 psf		
	Roof Width			Roof Width			Roof Width			Roof Width		
	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft
2 × 8 @ 12″	20″ (177)	15″ (227)	—	18″ (209)	—	—	—	—	—	—	—	—
2 × 10 @ 16″	29″ (228)	21″ (297)	16″ (364)	26″ (271)	18″ (354)	—	20″ (375)	—	—	—	—	—
2 × 10 @ 12″	36″ (166)	26″ (219)	20″ (270)	34″ (198)	22″ (263)	16″ (324)	26″ (277)	—	—	19″ (356)	—	—
2 × 12 @ 16″	—	32″ (287)	25″ (356)	36″ (263)	29″ (345)	21″ (428)	29″ (367)	20″ (484)	—	23″ (471)	—	—
2 × 12 @ 12″	—	42″ (209)	31″ (263)	—	37″ (253)	27″ (317)	36″ (271)	27″ (358)	17″ (447)	31″ (348)	19″ (462)	—
2 × 12 @ 8″	—	48″ (136)	45″ (169)	—	48″ (164)	38″ (206)	—	40″ (233)	26″ (294)	36″ (230)	29″ (304)	18″ (379)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Tabulated values are for clear-span roof supported solely by exterior bearing walls.

b. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir for repetitive (three or more) members.

c. Ratio of backspan to cantilever span shall be at least 3:1.

d. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.

e. Uplift force is for a backspan to cantilever span ratio of 3:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 3 divided by the actual backspan ratio provided (3/backspan ratio).

f. See Section R301.2.2.2.5, Item 1, for additional limitations on cantilevered floor joists for detached one- and two-family dwellings in Seismic Design Category D_0, D_1, or D_2 and townhouses in Seismic Design Category C, D_0, D_1 or D_2.

g. A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. Where the cantilever length is 24 inches (610 mm) or less and the building is assigned to Seismic Design Category A, B or C, solid blocking at the supported end shall not be required.

h. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY[a, b, e, f]

Member Size	Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in lb)[c, d]		
		Ground Snow Load		
		≤ 30 psf	50 psf	70 psf

2 × 8	12″	42″ (139)	39″ (156)	34″ (165)
2 × 8	16″	36″ (151)	34″ (171)	29″ (180)
2 × 10	12″	61″ (164)	57″ (189)	49″ (201)
2 × 10	16″	53″ (180)	49″ (208)	42″ (220)
2 × 10	24″	43″ (212)	40″ (241)	34″ (255)
2 × 12	16″	72″ (228)	67″ (260)	57″ (268)
2 × 12	24″	58″ (279)	54″ (319)	47″ (330)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir for repetitive (three or more) members.

b. Ratio of backspan to cantilever span shall be at least 2:1.

c. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.

d. Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 2 divided by the actual backspan ratio provided (2/backspan ratio).

e. A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. <u>Where the cantilever length is 24 inches (610 mm) or less and the building is assigned to Seismic Design Category A, B or C, solid blocking at the supported end shall not be required.</u>

f. Linear interpolation shall be permitted for ground snow loads other than shown.

Reason: The purpose of this code change proposal is to restore an exception to the requirement for full-depth blocking at the supported end of cantilever for low-seismic areas and short cantilevers. This exception was originally proposed by the Virginia Building and Code Officials Association as part of a revision to 2006 IRC Section R602.10.8 (RB225-06/07) and approved for the 2009 IRC (see 2009 IRC Section 602.10.7, Item #1). The provision made sense as the full-depth rim joist is close enough to the cantilever support (24" or less) to provide the rotational restraint that would otherwise be provided by the blocking at the support. There is no need for two closely-spaced sets of full-depth blocking in the specified case.

During the ICC Ad-Hoc Wall Bracing Committee's work on the "Mothership" proposal (RB105-09/10), it was realized the provision in R602.10 conflicted with existing footnotes in Tables R502.3.3(1) and R502.3.3.(2). The Ad-Hoc Committee opted to remove the exception rather than attempting to fix the conflict, leaving just a pointer allowing cantilevered floor joists complying with Section R502.3.3 to support braced wall panels. This proposal restores the original intent of the 2006/2007 VBCOA proposal by adding the exception to the two footnotes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB247-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.3.3(1)T-EHRLICH.doc

RB248 – 13

Table R502.3.1(1), Table R502.3.1(2), Table 802.4(1), Table R802.4(2), Table R802.5.1(1) through Table R802.5.1(8)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential sleeping areas, live load = 30 psf, L/Δ = 360)[a]

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 X 6	2 X 8	2 X 10	2 X 12	2 X 6	2 X 8	2 X 10	2 X 12
			Maximum floor joist spans							
			(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)
12	Douglas fir-larch	#2	11-10	15-7	19-10	~~23-0~~ 23-4	~~11-6~~ 11-8	~~14-7~~ 14-9	~~17-9~~ 18-0	~~20-7~~ 20-11
	Douglas fir-larch	#3	~~9-8~~ 9-11	~~12-4~~ 12-7	~~15-0~~ 15-5	~~17-5~~ 17-10	~~8-8~~ 8-11	~~11-0~~ 11-3	~~13-5~~ 13-9	~~15-7~~ 16-0
	Hem-Fir	#1	11-7	15-3	19-5	23-7	11-7	~~15-2~~ 15-3	~~18-6~~ 18-9	~~21-6~~ 21-9
16	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	~~23-0~~ 23-3
	Douglas fir-larch	#2	10-9	~~14-1~~ 14-2	~~17-2~~ 17-5	~~19-11~~ 20-3	~~9-11~~ 10-1	~~12-7~~ 12-9	~~15-5~~ 15-7	~~17-10~~ 18-1
	Douglas fir-larch	#3	~~8-5~~ 8-7	~~10-8~~ 10-11	~~13-0~~ 13-4	~~15-1~~ 15-5	~~7-6~~ 7-8	~~9-6~~ 9-9	~~11-8~~ 11-11	~~13-6~~ 13-10
	Hem-Fir	#1	10-6	13-10	17-8	~~20-9~~ 21-1	~~10-4~~ 10-6	~~13-1~~ 13-4	~~16-0~~ 16-3	~~18-7~~ 18-10
19.2	Douglas fir-larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	~~21-0~~ 21-4
	Douglas fir-larch	#2	10-1	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-3~~ 18-6	~~9-1~~ 9-3	~~11-6~~ 11-8	~~14-1~~ 14-3	~~16-3~~ 16-6
	Douglas fir-larch	#3	~~7-8~~ 7-10	~~9-9~~ 10-0	~~11-10~~ 12-2	~~13-9~~ 14-1	~~6-10~~ 7-0	~~8-8~~ 8-11	~~10-7~~ 10-11	~~12-4~~ 12-7
	Hem-Fir	#1	9-10	13-0	~~16-4~~ 16-7	~~19-0~~ 19-3	~~9-6~~ 9-7	~~12-0~~ 12-2	~~14-8~~ 14-10	~~17-0~~ 17-2
24	Douglas fir-larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	~~16-2~~ 16-5	~~18-9~~ 19-1
	Douglas fir-larch	#2	~~9-1~~ 9-3	~~11-6~~ 11-8	~~14-1~~ 14-3	~~16-3~~ 16-6	~~8-1~~ 8-3	~~10-3~~ 10-5	~~12-7~~ 12-9	~~14-7~~ 14-9
	Douglas fir-larch	#3	~~6-10~~ 7-0	~~8-8~~ 8-11	~~10-7~~ 10-11	~~12-4~~ 12-7	~~6-2~~ 6-3	~~7-9~~ 8-0	~~9-6~~ 9-9	~~11-0~~ 11-3
	Hem-Fir	#1	9-2	~~12-0~~ 12-1	~~14-8~~ 14-10	~~17-0~~ 17-2	~~8-6~~ 8-7	~~10-9~~ 10-10	~~13-1~~ 13-3	~~15-2~~ 15-5

(Portions of Table not shown remain unchanged)

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)[b]

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 X 6	2 X 8	2 X 10	2 X 12	2 X 6	2 X 8	2 X 10	2 X 12
			Maximum floor joist spans							
			(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)
12	Douglas fir-larch	#2	10-9	14.2	~~17-9~~ 18-0	~~20-7~~ 20-11	~~10-6~~ 10-8	~~13-3~~ 13-6	~~16-3~~ 16-5	~~18-10~~ 19-1
	Douglas fir-larch	#3	~~8-8~~ 8-11	~~11-0~~ 11-3	~~13-5~~ 13-9	~~15-7~~ 16-0	~~7-11~~ 8-1	~~10-0~~ 10-3	~~12-3~~ 12-7	~~14-3~~ 14-7
	Hem-Fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	~~16-11~~ 17-1	~~19-7~~ 19-10
16	Douglas fir-larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	~~21-0~~ 21-1
	Douglas fir-larch	#2	9-9	~~12-7~~ 12-9	~~15-5~~ 15-7	~~17-10~~ 18-1	~~9-1~~ 9-3	~~11-6~~ 11-8	~~14-1~~ 14-3	~~16-3~~ 16-6
	Douglas fir-larch	#3	~~7-6~~ 7-8	~~9-6~~ 9-9	~~11-8~~ 11-11	~~13-6~~ 13-10	~~6-10~~ 7-0	~~8-8~~ 8-11	~~10-7~~ 10-11	~~12-4~~ 12-7
	Hem-Fir	#1	9-6	12-7	16-0	~~18-7~~ 18-10	9-6	~~12-0~~ 12-2	~~14-8~~ 14-10	~~17-0~~ 17-2
19.2	Douglas fir-larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	~~19-2~~ 19-6
	Douglas fir-larch	#2	~~9-1~~ 9-2	~~11-6~~ 11-8	~~14-1~~ 14-3	~~16-3~~ 16-6	~~8-3~~ 8-5	~~10-6~~ 10-8	~~12-10~~ 13-0	~~14-10~~ 15-1
	Douglas fir-larch	#3	~~6-10~~ 7-0	~~8-8~~ 8-11	~~10-7~~ 10-11	~~12-4~~ 12-7	~~6-3~~ 6-5	~~7-11~~ 8-2	~~9-8~~ 9-11	~~11-3~~ 11-6
	Hem-Fir	#1	9-0	11-10	~~14-8~~ 14-10	~~17-0~~ 17-2	~~8-8~~ 8-9	~~10-11~~ 11-1	~~13-4~~ 13-6	~~15-6~~ 15-8
24	Douglas fir-larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	~~14-9~~ 15-0	~~17-1~~ 17-5
	Douglas fir-larch	#2	~~8-1~~ 8-3	~~10-3~~ 10-5	~~12-7~~ 12-9	~~14-7~~ 14-9	~~7-5~~ 7-6	~~9-5~~ 9-6	~~11-6~~ 11-8	~~13-4~~ 13-6
	Douglas fir-larch	#3	~~6-2~~ 6-3	~~7-9~~ 8-0	~~9-6~~ 9-9	~~11-0~~ 11-3	~~5-7~~ 5-9	~~7-1~~ 7-3	~~8-8~~ 8-11	~~10-1~~ 10-4
	Hem-Fir	#1	8-4	~~10-9~~ 10-10	~~13-1~~ 13-3	~~15-2~~ 15-5	~~7-9~~ 7-10	~~9-9~~ 9-11	~~11-11~~ 12-1	~~13-10~~ 14-0

(Portions of Table not shown remain unchanged)

Revise as follows:

TABLE R802.4(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Douglas fir – larch	#3	~~10-10~~ 11-1	~~15-10~~ 16-3	~~20-1~~ 20-7	~~24-6~~ 25-2
16	Douglas fir – larch	#2	11-3	17-8	~~23-0~~ 23-4	Note a
	Douglas fir – larch	#3	~~9-5~~ 9-7	~~13-9~~ 14-1	~~17-5~~ 17-10	~~21-3~~ 21-9
	Southern Pine	#1	11-16	18-1	~~23-1~~ 23-10	Note a
19.2	Douglas fir – larch	#2	10-7	~~16-7~~	~~21-0~~	~~25-~~

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
				16-8	21-4	26-0
	Douglas fir – larch	#3	~~8-7~~ 8-9	~~12-6~~ 12-10	~~15-10~~ 16-3	~~19-5~~ 19-10
24	Douglas fir – larch	#2	9-10	~~14-10~~ 15-0	~~18-9~~ 19-1	~~22-11~~ 23-3
	Douglas fir – larch	#3	~~7-8~~ 7-10	~~11-2~~ 11-6	~~14-2~~ 14-7	~~17-4~~ 17-9
	Hem-Fir	#1	9-8	15.2	~~19-7~~ 19-10	~~23-11~~ 24-3

(Portions of Table not shown remain unchanged)

TABLE R802.4(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Douglas fir – larch	#2	9-10	~~14-10~~ 15-0	~~18-9~~ 19-1	~~22-11~~ 23-3
	Douglas fir – larch	#3	~~7-8~~ 7-10	~~11-2~~ 11-6	~~14-2~~ 14-7	~~17-4~~ 17-9
	Hem-Fir	#1	9-8	15-2	~~19-7~~ 19-10	~~23-11~~ 24-3
16	Douglas fir – larch	#2	~~8-9~~ 8-11	~~12-10~~ 13-0	~~16-3~~ 16-6	~~19-10~~ 20-2
	Douglas fir – larch	#3	~~6-8~~ 6-10	~~9-8~~ 9-11	~~12-4~~ 12-7	~~15-0~~ 15-5
	Hem-Fir	#1	8-9	~~13-5~~ 13-7	~~16-10~~ 17-2	~~20-8~~ 21-0
19.2	Douglas fir – larch	SS	8-11	14-0	18-5	~~23-4~~ 23-7
	Douglas fir – larch	#2	~~8-0~~ 8-2	~~11-09~~ 11-11	~~14-10~~ 15-1	~~18-2~~ 18-5
	Douglas fir – larch	#3	~~6-1~~ 6-2	~~8-10~~ 9-1	~~11-3~~ 11-6	~~13-8~~ 14-1
	Hem-Fir	#1	8-3	~~12-3~~ 12-4	~~15-6~~ 15-8	~~18-11~~ 19-2
24	Douglas fir – larch	SS	8-3	13-0	~~17-1~~ 17-2	~~20-11~~ 21-3
	Douglas fir – larch	#2	~~7-2~~ 7-3	~~10-6~~ 10-8	~~13-3~~ 13-6	~~16-3~~ 16-5
	Douglas fir – larch	#3	~~5-5~~ 5-7	~~7-11~~ 8-1	~~10-0~~ 10-3	~~12-3~~ 12-
	Hem-Fir	#1	~~7-6~~ 7-7	~~10-11~~ 11-1	~~13-10~~ 14-0	~~16-11~~ 17-1

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	~~23-5~~ 23-9	Note b	Note b
	Douglas fir-larch	#2	10-10	~~16-7~~ 16-10	~~21-0~~ 21-4	~~25-8~~ 26-0	Note b	~~9-10~~ 10-0	~~14-4~~ 14-7	~~18-2~~ 18-5	~~22-3~~ 22-6	~~25-9~~ 26-0
	Douglas fir-larch	#3	~~8-7~~ 8-9	~~12-6~~ 12-10	~~15-10~~ 16-3	~~19-5~~ 19-10	~~22-6~~ 23-0	~~7-5~~ 7-7	~~10-10~~ 11-1	~~13-9~~ 14-1	~~16-9~~ 17-2	~~19-6~~ 19-11
	Hem-Fir	#1	10-7	16-8	~~21-10~~ 22-0	Note b	Note b	~~10-3~~ 10-4	~~14-11~~ 15-2	~~18-11~~ 19-2	~~23-2~~ 23-5	Note b
16	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	~~16-0~~ 16-3	~~20-3~~ 20-7	~~24-9~~ 25-2	Note b
	Douglas fir-larch	#2	9-10	~~14-4~~ 14-7	~~18-2~~ 18-5	~~22-3~~ 22-6	~~25-9~~ 26-0	~~8-6~~ 8-7	~~12-5~~ 12-7	~~15-9~~ 16-0	~~19-3~~ 19-6	~~22-4~~ 22-7
	Douglas fir-larch	#3	~~7-5~~ 7-7	~~10-10~~ 11-1	~~13-9~~ 14-1	~~16-9~~ 17-2	~~19-6~~ 19-11	~~6-5~~ 6-7	~~9-5~~ 9-8	~~11-11~~ 12-12	~~14-6~~ 14-11	~~16-10~~ 17-3
	Hem-Fir	#1	9-8	~~14-11~~ 15-2	~~18-11~~ 19-2	~~23-2~~ 23-5	Note b	~~8-10~~ 9-0	~~12-11~~ 13-1	~~16-5~~ 16-7	~~20-0~~ 20-4	~~23-3~~ 23-7
19.2	Douglas fir-larch	SS	9-10	15-5	20-4	24.11	Note b	9-10	~~14-7~~ 14-10	~~18-6~~ 18-10	~~22-7~~ 23-0	Note b
	Douglas fir-larch	#2	~~8-11~~ 9-1	~~13-1~~ 13-3	~~16-7~~ 16-10	~~20-3~~ 20-7	~~23-6~~ 23-10	~~7-9~~ 7-10	~~11-4~~ 11-6	~~14-4~~ 14-7	~~17-7~~ 17-10	~~20-4~~ 20-8
	Douglas fir-larch	#3	~~6-9~~ 6-11	~~9-11~~ 10-2	~~12-7~~ 12-10	~~15-4~~ 15-8	~~17-9~~ 18-3	~~5-10~~ 6-0	~~8-7~~ 8-9	~~10-10~~ 11-2	~~13-3~~ 13-7	~~15-5~~ 15-9
	Hem-Fir	#1	~~9-1~~	~~13-8~~ 13-10	~~17-4~~ 17-6	~~21-1~~ 21-5	~~24-6~~ 24-10	~~8-1~~ 8-2	~~11-10~~ 12-0	~~15-0~~ 15-2	~~18-4~~ 18-6	~~21-3~~ 21-6
24	Douglas fir-larch	SS	9-1	14-4	18-0	~~23-4~~ 23-9	Note b	~~8-11~~ 9-1	~~13-1~~ 13-3	~~16-7~~ 16-10	~~20-3~~ 20-7	~~23-5~~ 23-10
	Douglas fir-larch	#2	~~8-0~~ 8-2	~~11-9~~ 11-11	~~14-10~~ 15-1	~~18-2~~ 18-5	~~21-0~~ 21-4	~~6-11~~ 7-0	~~10-2~~ 10-4	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-3~~ 18-6
	Douglas fir-larch	#3	~~6-1~~ 6-2	~~8-10~~ 9-1	~~11-3~~ 11-6	~~13-8~~ 14-1	~~15-11~~ 16-3	~~5-3~~ 5-4	~~7-8~~ 7-10	~~9-9~~ 10-0	~~11-10~~ 12-2	~~13-9~~ 14-1
	Hem-Fir	#1	~~8-4~~ 8-5	~~12-3~~ 12-4	~~15-6~~ 15-8	~~18-11~~ 19-2	~~21-11~~ 22-2	~~7-3~~ 7-4	~~10-7~~ 10-9	~~13-5~~ 13-7	~~16-4~~ 16-7	~~19-0~~ 19-3

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	#2	9-10	15-6	20-5	~~25-8~~ 26-0	Note b	9-10	~~14-4~~ 14-7	~~18-2~~ 18-5	~~22-3~~ 22-6	~~25-9~~ 26-0
	Douglas fir-larch	#3	~~8-7~~ 8-9	~~12-6~~ 12-10	~~15-10~~ 16-3	~~19-5~~ 19-10	~~22-6~~ 23-0	~~7-5~~ 7-7	~~10-10~~ 11-1	~~13-9~~ 14-1	~~16-9~~ 17-2	~~19-6~~ 19-11
	Hem-Fir	#1	9-8	15-2	19-11	25-5	Note b	9-8	~~14-11~~ 15-2	~~18-11~~ 19-2	~~23-2~~ 23-5	Note b
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	~~24-9~~ 25-0	Note b
	Douglas fir-larch	#2	8-11	14-1	~~18-2~~ 18-5	~~22-3~~ 22-6	~~25-9~~ 26.0	~~8-6~~ 8-7	~~12-5~~ 12-7	~~15-9~~ 16-0	~~19-3~~ 19-6	~~22-4~~ 22-7

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Douglas fir-larch	#3	~~7-5~~ 7-7	~~10-10~~ 11-1	~~13-9~~ 14-1	~~16-9~~ 17-2	~~19-6~~ 19-11	~~6-5~~ 6-7	~~9-5~~ 9-8	~~11-11~~ 12-2	~~14-6~~ 14-11	~~16-10~~ 17-3
	Hem-Fir	#1	8-9	13-9	18-1	23-1	Note b	8-9	~~12-11~~ 13-1	~~16-5~~ 16-7	~~20-0~~ 20-4	~~23-3~~ 23-7
19.2	Douglas fir-larch	SS	18-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	~~22-7~~ 23-0	Note b
	Douglas fir-larch	#2	8-5	~~13-1~~ 13-3	~~16-7~~ 16-10	~~20-3~~ 20-7	~~23-6~~ 23-10	~~7-9~~ 7-10	~~11-4~~ 11-6	~~14-4~~ 14-7	~~17-7~~ 17-10	~~20-4~~ 20-8
	Douglas fir-larch	#3	~~6-9~~ 6-11	~~9-11~~ 10-2	~~12-7~~ 12-10	~~15-4~~ 15-8	~~17-9~~ 18-3	~~5-10~~ 6-0	~~8-7~~ 8-9	~~10-10~~ 11-2	~~13-3~~ 13-7	~~15-5~~ 15-9
	Hem-Fir	#1	8-3	12-11	17-1	~~21-1~~ 21-5	~~24-6~~ 24-10	~~8-1~~ 8-2	~~11-10~~ 12-0	~~15-0~~ 15-2	~~18-4~~ 18-6	~~21-3~~ 21-6
24	Douglas fir-larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	~~16-7~~ 16-10	~~20-3~~ 20-7	~~23-5~~ 23-10
	Douglas fir-larch	#2	7-10	~~11-9~~ 11-11	~~14-10~~ 15-1	~~18-2~~ 18-5	~~21-0~~ 21-4	~~6-11~~ 7-0	~~10-2~~ 10-4	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-3~~ 18-6
	Douglas fir-larch	#3	~~6-1~~ 6-2	~~8-10~~ 9-1	~~11-3~~ 11-6	~~13-8~~ 14-1	~~15-11~~ 16-3	~~5-3~~ 5-4	~~7-8~~ 7-10	~~9-9~~ 10-0	~~11-10~~ 12-2	~~13-9~~ 14-1
	Hem-Fir	#1	7-8	12-10	~~15-6~~ 15-8	~~18-11~~ 19-2	~~21-11~~ 22-2	~~7-3~~ 7-4	~~10-7~~ 10-9	~~13-5~~ 13-7	~~16-4~~ 16-7	~~19-0~~ 19-3

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 30 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	~~20-1~~ 20-5	~~24-6~~ 24-11	Note b
	Douglas fir-larch	#2	~~9-5~~ 9-6	~~13-9~~ 14-0	~~17-5~~ 17-8	~~21-4~~ 21-7	~~24-8~~ 25-1	~~8-5~~ 8-6	~~12-4~~ 12-6	~~15-7~~ 15-10	~~19-1~~ 19-4	~~22-1~~ 22-5
	Douglas fir-larch	#3	~~7-1~~ 7-3	~~10-5~~ 10-8	~~13-2~~ 13-6	~~16-1~~ 16-6	~~18-8~~ 19-2	~~6-4~~ 6-6	~~9-4~~ 9-6	~~11-9~~ 12-1	~~14-5~~ 14-9	~~16-8~~ 17-1
	Hem-Fir	#1	9-3	~~14-4~~ 14-6	~~18-2~~ 18-5	~~22-2~~ 22-6	~~25-9~~ 26-0	~~8-9~~ 8-11	~~12-10~~ 13-0	~~16-3~~ 16-6	~~19-10~~ 20-1	~~23-0~~ 23-4
16	Douglas fir-larch	SS	9-1	14-4	18-10	~~23-9~~ 24-1	Note b	9-1	~~13-9~~ 14-0	~~17-5~~ 17-8	~~21-3~~ 21-7	~~24-8~~ 25-1
	Douglas fir-larch	#2	~~8-2~~ 8-3	~~11-11~~ 12-1	~~15-1~~ 15-4	~~18-5~~ 18-9	~~21-5~~ 21-8	~~7-3~~ 7-5	~~10-8~~ 10-10	~~13-6~~ 13-8	~~16-6~~ 16-9	~~19-2~~ 19-5
	Douglas fir-larch	#3	~~6-2~~ 6-4	~~9-0~~ 9-3	~~11-5~~ 11-8	~~13-11~~ 14-3	~~16-2~~ 16-7	~~5-6~~ 5-8	~~8-1~~ 8-3	~~10-3~~ 10-6	~~12-6~~ 12-9	~~14-6~~ 14-10
	Hem-Fir	#1	8-5	~~12-5~~ 12-7	~~15-9~~ 15-11	~~19-3~~ 19-6	~~22-3~~ 22-7	~~7-7~~ 7-8	~~11-1~~ 11-3	~~14-1~~ 14-3	~~17-2~~ 17-5	~~19-11~~ 20-2
19.2	Douglas fir-larch	SS	8-7	13-6	17-9	~~21-8~~ 22-1	~~25-2~~ 25-7	8-7	~~12-6~~ 12-9	~~15-10~~ 16-2	~~19-5~~ 19-9	~~22-6~~ 22-10
	Douglas fir-larch	#2	~~7-5~~ 7-7	~~10-11~~ 11-0	~~13-9~~ 14-0	~~16-10~~ 17-1	~~19-6~~ 19-10	~~6-8~~ 6-9	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Douglas fir-larch	#3	~~5-7~~ 5-9	~~8-3~~ 8-5	~~10-5~~ 10-8	~~12-9~~ 13-1	~~14-9~~ 15-2	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6
	Hem-Fir	#1	~~7-9~~ 7-10	~~11-4~~ 11-6	~~14-4~~ 14-7	~~17-7~~ 17-9	~~20-4~~ 20-7	~~6-11~~ 7-0	~~10-2~~ 10-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5
24	Douglas fir-larch	SS	~~7-11~~ 8-0	12-6	~~15-10~~ 16-2	~~19-5~~ 19-9	~~22-6~~ 22-10	~~7-8~~ 7-10	~~11-3~~ 11-5	~~14-2~~ 14-5	~~17-4~~ 17-8	~~20-1~~ 20-5
	Douglas fir-larch	#2	~~6-8~~ 6-9	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~5-11~~ 6-0	~~8-8~~ 8-10	~~11-0~~ 11-2	~~13-6~~ 13-8	~~15-7~~ 15-10
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-6~~ 4-7	~~6-7~~ 6-9	~~8-4~~ 8-7	~~10-2~~ 10-5	~~11-10~~ 12-1
	Hem-Fir	#1	~~6-11~~ 7-0	~~10-2~~ 10-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	~~6-2~~ 6-3	~~9-1~~ 9-2	~~11-6~~ 11-8	~~14-0~~ 14-3	~~16-3~~ 16-6

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	~~17-0~~ 17-3	~~20-9~~ 21-1	~~24-0~~ 24-5
	Douglas fir-larch	#2	~~7-8~~ 7-10	~~11-3~~ 11-5	~~14-3~~ 14-5	~~17-5~~ 17-8	~~20-2~~ 20-5	~~7-1~~ 7-3	~~10-5~~ 10-7	~~13-2~~ 13-4	~~16-1~~ 16-4	~~18-8~~ 18-11
	Douglas fir-larch	#3	~~5-10~~ 6-0	~~8-6~~ 8-9	~~10-9~~ 11-0	~~13-2~~ 13-6	~~15-3~~ 15-7	~~5-5~~ 5-6	~~7-10~~ 8-1	~~10-0~~ 10-3	~~12-2~~ 12-6	~~14-1~~ 14-6
	Hem-Fir	#1	7-10	~~11-9~~ 11-10	~~14-10~~ 15-0	~~18-1~~ 18-4	~~21-0~~ 21-3	~~7-5~~ 7-6	~~10-10~~ 11-0	~~13-9~~ 13-11	~~16-9~~ 17-0	~~19-5~~ 19-9
16	Douglas fir-larch	SS	7-8	12-1	~~15-10~~ 15-11	~~19-5~~ 19-9	~~22-6~~ 22-10	7-8	~~11-7~~ 11-10	~~14-8~~ 14-11	~~17-11~~ 18-3	~~20-10~~ 21-2
	Douglas fir-larch	#2	~~6-8~~ 6-9	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~6-2~~ 6-3	~~9-0~~ 9-2	~~11-5~~ 11-7	~~13-11~~ 14-2	~~16-2~~ 16-5
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-8~~ 4-9	~~6-10~~ 7-0	~~8-8~~ 8-10	~~10-6~~ 10-10	~~12-3~~ 12-6
	Hem-Fir	#1	~~6-11~~ 7-0	~~10-2~~ 10-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	~~6-5~~ 6-6	~~9-5~~ 9-6	~~11-11~~ 12-1	~~14-6~~ 14-9	~~16-10~~ 17-1
19.2	Douglas fir-larch	SS	7-3	11-4	~~14-6~~ 14-9	~~17-8~~ 18-0	~~20-6~~ 20-11	7-3	~~10-7~~ 10-9	~~13-5~~ 13-8	~~16-5~~ 16-8	~~19-0~~ 19-4
	Douglas fir-larch	#2	~~6-1~~ 6-2	~~8-11~~ 9-0	~~11-3~~ 11-5	~~13-9~~ 13-11	~~15-11~~ 16-2	~~5-7~~ 5-8	~~8-3~~ 8-4	~~10-5~~ 10-7	~~12-9~~ 12-11	~~14-9~~ 15-0
	Douglas fir-larch	#3	~~4-7~~ 4-8	~~6-9~~ 6-11	~~8-6~~ 8-9	~~10-5~~ 10-8	~~12-1~~ 12-4	~~4-3~~ 4-4	~~6-3~~ 6-4	~~7-11~~ 8-1	~~9-7~~ 9-10	~~11-2~~ 11-5
	Hem-Fir	#1	~~6-4~~ 6-5	~~9-3~~ 9-5	~~11-9~~ 11-11	~~14-4~~ 14-6	~~16-7~~ 16-10	~~5-10~~ 8-11	~~8-7~~ 8-8	~~10-10~~ 11-0	~~13-3~~ 13-5	~~15-5~~ 15-7
24	Douglas fir-larch	SS	6-8	~~10-~~ 10-5	~~13-0~~ 13-2	~~15-10~~ 16-1	~~18-4~~ 18-8	~~6-6~~ 6-7	~~9-6~~ 9-8	~~12-0~~ 12-2	~~14-8~~ 14-11	~~17-0~~ 17-3

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Douglas fir-larch	#2	~~5-5~~ 5-6	~~7-11~~ 8-1	~~10-1~~ 10-3	~~12-4~~ 12-6	~~14-3~~ 14-6	~~5-0~~ 5-1	~~7-4~~ 7-6	~~9-4~~ 9-5	~~11-5~~ 11-7	~~13-2~~ 13-5
	Douglas fir-larch	#3	~~4-1~~ 4-3	~~6-0~~ 6-2	~~7-7~~ 7-10	~~9-4~~ 9-6	~~10-9~~ 11-1	~~3-10~~ 3-11	~~5-7~~ 5-8	~~7-1~~ 7-3	~~8-7~~ 8-10	~~10-0~~ 10-3
	Hem-Fir	#1	~~5-8~~ 5-9	~~8-3~~ 8-5	~~10-6~~ 10-8	~~12-10~~ 13-0	~~14-10~~ 15-1	~~5-3~~ 8-4	~~7-8~~ 7-9	~~9-9~~ 9-10	~~11-10~~ 12-0	~~13-9~~ 13-11

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	#2	8-7	13-6	~~17-5~~ 17-8	~~21-4~~ 21-7	~~24-8~~ 25-1	~~8-5~~ 8-6	~~12-4~~ 12-6	~~15-7~~ 15-10	~~19-1~~ 19-4	~~22-1~~ 22-5
	Douglas fir-larch	#3	~~7-1~~ 7-3	~~10-5~~ 10-8	~~13-2~~ 13-6	~~16-1~~ 16-6	~~18-8~~ 19-2	~~6-4~~ 6-6	~~9-4~~ 9-6	~~11-9~~ 12-1	~~14-5~~ 14-9	~~16-8~~ 17-1
	Hem-Fir	#1	8-5	13-3	17-5	~~22-2~~ 22-3	~~25-9~~ 26-0	8-5	~~12-10~~ 13-0	~~16-3~~ 16-6	~~19-10~~ 20-1	~~23-0~~ 23-4
16	Douglas fir-larch	SS	8-3	13-0	17-2	21-0	Note b	8-3	13-0	17-2	~~21-3~~ 21-7	~~24-8~~ 25-1
	Douglas fir-larch	#2	7-10	~~11-11~~ 12-1	~~15-1~~ 15-4	~~18-5~~ 18-9	~~21-5~~ 21-8	~~7-3~~ 7-5	~~10-8~~ 10-10	~~13-6~~ 13-8	~~16-6~~ 16-9	~~19-2~~ 19-5
	Douglas fir-larch	#3	~~6-2~~ 6-4	~~9-0~~ 9-3	~~11-5~~ 11-8	~~13-11~~ 14-3	~~16-2~~ 16-7	~~5-6~~ 5-8	~~8-1~~ 8-3	~~10-3~~ 10-6	~~12-6~~ 12-9	~~14-6~~ 14-10
	Hem-Fir	#1	7-8	12-0	~~15-9~~ 15-10	~~19-3~~ 19-6	~~22-3~~ 22-7	~~7-7~~ 7-8	~~11-1~~ 11-3	~~14-1~~ 14-3	~~17-2~~ 17-5	~~19-11~~ 20-2
19.2	Douglas fir-larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	~~15-10~~ 16-1	~~19-5~~ 19-9	~~22-6~~ 22-10
	Douglas fir-larch	#2	7-4	~~10-11~~ 11-0	~~13-9~~ 14-0	~~16-10~~ 17-1	~~19-6~~ 19-10	~~6-8~~ 6-9	~~9-9~~ 9-1	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9
	Douglas fir-larch	#3	~~5-7~~ 5-9	~~8-3~~ 8-5	~~10-5~~ 10-8	~~12-9~~ 13-1	~~14-9~~ 15-2	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6
	Hem-Fir	#1	7-2	11-4	~~14-4~~ 14-7	~~17-7~~ 17-9	~~20-4~~ 20-7	~~6-11~~ 7-0	~~16-2~~ 16-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5
24	Douglas fir-larch	SS	7-3	11-4	15-0	19-1	~~22-6~~ 22-10	7-3	~~11-3~~ 11-4	~~14-2~~ 14-5	~~17-4~~ 17-8	~~20-1~~ 20-5
	Douglas fir-larch	#2	~~6-8~~ 6-9	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~5-11~~ 6-0	~~8-8~~ 8-10	~~11-0~~ 11-2	~~13-6~~ 13-8	~~15-7~~ 15-10
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-6~~ 4-7	~~6-7~~ 6-9	~~8-4~~ 8-7	~~10-2~~ 10-5	~~11-10~~ 12-1
	Hem-Fir	#1	6-8	~~10-2~~ 10-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	~~6-2~~ 6-3	~~9-1~~ 9-2	~~11-6~~ 11-8	~~14-0~~ 14-3	~~16-3~~ 16-6

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-1	20-3	~~24-0~~ 24-5
	Douglas fir-larch	#2	7-3	~~11-3~~ 11-5	~~14-3~~ 14-5	~~17-5~~ 17-8	~~20-2~~ 20-5	~~7-1~~ 7-3	~~10-5~~ 10-7	~~13-2~~ 13-4	~~16-1~~ 16-4	~~18-8~~ 18-11
	Douglas fir-larch	#3	~~5-10~~ 6-0	~~8-6~~ 8-9	~~10-9~~ 11-0	~~13-2~~ 13-6	~~15-3~~ 15-7	~~5-5~~ 5-6	~~7-10~~ 8-1	~~10-0~~ 10-3	~~12-2~~ 12-6	~~14-1~~ 14-6
	Hem-Fir	#1	7-1	11-2	14-8	~~18-1~~ 18-4	~~21-0~~ 21-3	7-1	~~10-10~~ 11-0	~~13-9~~ 13-11	~~16-9~~ 17-0	~~19-5~~ 19-9
16	Douglas fir-larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	~~17-11~~ 18-3	~~20-10~~ 21-2
	Douglas fir-larch	#2	6-7	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~6-2~~ 6-3	~~9-0~~ 9-2	~~11-5~~ 11-7	~~13-11~~ 14-2	~~16-2~~ 16-5
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-8~~ 4-9	~~6-10~~ 7-0	~~8-8~~ 8-10	~~10-6~~ 10-10	~~12-3~~ 12-6
	Hem-Fir	#1	~~6-5~~	10-2	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	6-5	~~9-5~~ 9-6	~~11-11~~ 12-1	~~14-6~~ 14-9	~~16-10~~ 17-1
19.2	Douglas fir-larch	SS	6-7	10-4	13-7	17-4	~~20-6~~ 20-11	6-7	10-4	~~13-5~~ 13-7	~~16-5~~ 16-8	~~19-0~~ 19-4
	Douglas fir-larch	#2	~~6-1~~ 6-2	~~8-11~~ 9-0	~~11-3~~ 11-5	~~13-9~~ 13-11	~~15-11~~ 16-2	~~5-7~~ 5-8	~~8-3~~ 8-4	~~10-5~~ 10-7	~~12-9~~ 12-11	~~14-9~~ 15-0
	Douglas fir-larch	#3	~~4-7~~ 4-8	~~6-9~~ 6-11	~~8-6~~ 8-9	~~10-5~~ 10-8	~~12-1~~ 12-4	~~4-3~~ 4-4	~~6-3~~ 6-4	~~7-11~~ 8-1	~~9-7~~ 9-10	~~11-2~~ 11-5
	Hem-Fir	#1	6-1	~~9-3~~ 9-5	~~11-9~~ 11-11	~~14-4~~ 14-6	~~16-7~~ 16-10	~~5-10~~ 5-11	~~8-7~~ 8-8	~~10-10~~ 11-0	~~13-3~~ 13-5	~~15-5~~ 15-7
24	Douglas fir-larch	SS	6-1	9-7	12-7	~~15-10~~ 16-1	~~18-4~~ 18-8	6-1	~~9-6~~ 9-7	~~12-0~~ 12-2	~~14-8~~ 14-11	~~17-0~~ 17-3
	Douglas fir-larch	#2	~~5-5~~ 5-6	~~7-11~~ 8-1	~~10-1~~ 10-3	~~12-4~~ 12-6	~~14-3~~ 14-6	~~5-0~~ 5-1	~~7-4~~ 7-6	~~9-4~~ 9-5	~~11-5~~ 11-7	~~13-2~~ 13-5
	Douglas fir-larch	#3	~~4-1~~ 4-3	~~6-0~~ 6-2	~~7-7~~ 7-10	~~9-4~~ 9-6	~~10-9~~ 11-1	~~3-10~~ 3-11	~~5-7~~ 5-8	~~7-1~~ 7-3	~~8-7~~ 8-10	~~10-0~~ 10-3
	Hem-Fir	#1	5-8	~~8-3~~ 8-5	~~10-6~~ 10-8	~~12-10~~ 13-0	~~14-10~~ 15-1	~~5-3~~ 5-4	~~7-8~~ 7-9	~~9-9~~ 9-10	~~11-10~~ 12-0	~~13-9~~ 13-11

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(7)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	7-7	11-0	15-8	~~19-5~~ 19-9	~~22-6~~ 22-10	7-7	11-10	~~15-0~~ 15-3	~~18-3~~ 18-7	~~21-2~~ 21-7
	Douglas fir-larch	#2	~~6-8~~ 6-9	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~6-3~~ 6-4	~~9-2~~ 9-4	~~11-8~~ 11-9	~~14-2~~ 14-5	~~16-6~~ 16-8
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-9~~ 4-10	~~6-11~~ 7-1	~~8-9~~ 9-0	~~10-9~~ 11-0	~~12-5~~ 12-9

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Hem-Fir	#1	~~6-11~~ 7-0	~~10-2~~ 10-3	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	~~6-6~~ 6-7	~~9-7~~ 9-8	~~12-1~~ 12-3	~~14-10~~ 15-0	~~17-2~~ 17-5
16	Douglas fir-larch	SS	6-10	10-9	~~13-9~~ 14-0	~~16-10~~ 17-1	~~19-6~~ 19-10	6-10	~~10-3~~ 10-5	~~13-0~~ 13-2	~~15-10~~ 16-1	~~18-4~~ 18-8
	Douglas fir-larch	#2	~~5-9~~ 5-10	~~8-5~~ 8-7	~~10-8~~ 10-10	~~13-1~~ 13-3	~~15-2~~ 15-4	~~5-5~~ 5-6	~~7-11~~ 8-1	~~10-1~~ 10-3	~~12-4~~ 12-6	~~14-3~~ 14-6
	Douglas fir-larch	#3	~~4-4~~ 4-6	~~6-4~~ 6-6	~~8-1~~ 8-3	~~9-10~~ 10-1	~~11-5~~ 11-9	~~4-1~~ 4-3	~~6-0~~ 6-2	~~7-7~~ 7-10	~~9-4~~ 9-6	~~10-9~~ 11-1
	Hem-Fir	#1	~~6-0~~ 6-1	~~8-9~~ 8-11	~~11-2~~ 11-3	~~13-7~~ 13-9	~~15-9~~ 16-0	~~5-8~~ 5-9	~~8-3~~ 8-5	~~10-6~~ 10-8	~~12-10~~ 13-0	~~14-10~~ 15-1
19.2	Douglas fir-larch	SS	~~6-5~~ 6-6	~~9-11~~ 10-1	~~12-7~~ 12-9	~~15-4~~ 15-7	~~17-9~~ 18-1	~~6-5~~ 6-6	~~9-4~~ 9-6	~~11-10~~ 12-0	~~14-5~~ 14-8	~~16-9~~ 17-1
	Douglas fir-larch	#2	~~5-3~~ 5-4	~~7-8~~ 7-10	~~9-9~~ 9-11	~~11-11~~ 12-1	~~13-10~~ 14-0	5-0	~~7-3~~ 7-4	~~9-2~~ 9-4	~~11-3~~ 11-5	~~13-0~~ 13-2
	Douglas fir-larch	#3	~~4-0~~ 4-1	~~5-10~~ 6-0	~~7-4~~ 7-7	~~9-0~~ 9-3	~~10-5~~ 10-8	~~3-9~~ 3-10	~~5-6~~ 5-7	~~6-11~~ 7-1	~~8-6~~ 8-8	~~9-10~~ 10-1
	Hem-Fir	#1	~~5-6~~ 5-7	~~8-0~~ 8-2	~~10-2~~ 10-3	~~12-5~~ 12-7	~~14-5~~ 14-7	~~5-2~~ 5-3	~~7-7~~ 7-8	~~9-7~~ 9-8	~~11-8~~ 11-10	~~13-7~~ 13-9
24	Douglas fir-larch	SS	6-0	~~8-10~~ 9-0	~~11-3~~ 11-5	~~13-9~~ 13-11	~~15-11~~ 16-2	~~5-9~~ 5-10	~~8-4~~ 8-6	~~10-7~~ 10-9	~~12-11~~ 13-2	~~15-0~~ 15-3
	Douglas fir-larch	#2	~~4-8~~ 4-9	~~6-11~~ 7-0	~~8-9~~ 8-10	~~10-8~~ 10-10	~~12-4~~ 12-6	~~4-5~~ 4-6	~~6-6~~ 6-7	~~8-3~~ 8-4	~~10-0~~ 10-2	~~11-8~~ 11-10
	Douglas fir-larch	#3	~~3-7~~ 3-8	~~5-2~~ 5-4	~~6-7~~ 6-9	~~8-1~~ 8-3	~~9-4~~ 9-7	~~3-4~~ 3-5	~~4-11~~ 5-0	~~6-3~~ 6-4	~~7-7~~ 7-9	~~8-10~~ 9-0
	Hem-Fir	#1	~~4-11~~ 5-0	~~7-2~~ 7-3	~~9-1~~ 9-2	~~11-1~~ 11-3	~~12-10~~ 13-0	~~4-7~~ 4-8	~~6-9~~ 6-10	~~8-7~~ 8-8	~~10-6~~ 10-7	~~12-2~~ 12-4

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(8)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, L/∆ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Douglas fir-larch	SS	6-10	10-9	14-3	18-2	22-1	6-10	10-9	14-3	18-2	~~21-2~~ 21-7
	Douglas fir-larch	#2	6-6	~~9-9~~ 9-10	~~12-4~~ 12-6	~~15-1~~ 15-3	~~17-6~~ 17-9	~~6-3~~ 6-4	~~9-2~~ 9-4	~~11-8~~ 11-9	~~14-2~~ 14-5	~~16-6~~ 16-8
	Douglas fir-larch	#3	~~5-0~~ 5-2	~~7-4~~ 7-7	~~9-4~~ 9-7	~~11-5~~ 11-8	~~13-2~~ 13-6	~~4-9~~ 4-10	~~6-11~~ 7-1	~~8-9~~ 9-0	~~10-9~~ 11-0	~~12-5~~ 12-9
	Hem-Fir	#1	~~6-4~~	10-0	~~12-10~~ 13-0	~~15-8~~ 15-11	~~18-2~~ 18-5	6-4	~~9-7~~ 9-8	~~12-1~~ 12-3	~~14-10~~ 15-0	~~17-2~~ 17-5
16	Douglas fir-larch	SS	6-3	9-10	12-11	16-6	~~19-6~~ 19-10	6-3	9-10	12-11	~~15-10~~ 16-1	~~18-4~~ 18-8
	Douglas fir-larch	#2	~~5-9~~ 5-10	~~8-5~~ 8-7	~~10-8~~ 10-10	~~13-1~~ 13-3	~~15-2~~ 15-4	~~5-5~~ 5-6	~~7-11~~ 8-1	~~10-1~~ 10-3	~~12-4~~ 12-6	~~14-3~~ 14-6

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Douglas fir-larch	#3	~~4-4~~ 4-6	~~6-4~~ 6-6	~~8-1~~ 8-3	~~9-10~~ 10-1	~~11-5~~ 11-9	~~4-1~~ 4-3	~~6-0~~ 6-2	~~7-7~~ 7-10	~~9-4~~ 9-6	~~10-9~~ 11-1
	Hem-Fir	#1	5-9	~~8-9~~ 8-11	~~11-2~~ 11-3	~~13-7~~ 13-9	~~15-9~~ 16-0	~~5-8~~ 5-9	~~8-3~~ 8-5	~~10-6~~ 10-8	~~12-10~~ 13-0	~~14-10~~ 15-1
19.2	Douglas fir-larch	SS	5-10	9-3	12-2	~~15-4~~ 15-6	~~17-9~~ 18-1	5-10	9-3	~~11-10~~ 12-0	~~14-5~~ 14-8	~~16-9~~ 17-1
	Douglas fir-larch	#2	~~5-3~~ 5-4	~~7-8~~ 7-10	~~9-9~~ 9-11	~~11-11~~ 12-1	~~13-10~~ 14-0	5-0	~~7-3~~ 7-4	~~9-2~~ 9-4	~~11-3~~ 11-5	~~13-0~~ 13-2
	Douglas fir-larch	#3	~~4-0~~ 4-1	~~5-10~~ 6-0	~~7-4~~ 7-7	~~9-0~~ 9-3	~~10-5~~ 10-8	~~3-9~~ 3-10	~~5-6~~ 5-7	~~6-11~~ 7-	~~8-6~~ 8-8	~~9-10~~ 10-1
	Hem-Fir	#1	5-5	~~8-0~~ 8-2	~~10-2~~ 10-3	~~12-5~~ 12-7	~~14-5~~ 14-7	~~5-2~~ 5-3	~~7-7~~ 7-8	~~9-7~~ 9-8	~~11-8~~ 11-10	~~13-7~~ 13-9
24	Douglas fir-larch	SS	5-5	8-7	11-3	~~13-9~~ 13-11	~~15-11~~ 16-2	5-5	~~8-4~~ 8-6	~~10-7~~ 10-9	~~12-11~~ 13-2	~~15-0~~ 15-3
	Douglas fir-larch	#2	~~4-8~~ 4-9	~~6-11~~ 7-0	~~8-9~~ 8-10	~~10-8~~ 10-10	~~12-4~~ 12-6	~~4-5~~ 4-6	~~6-6~~ 6-7	~~8-3~~ 8-4	~~10-0~~ 10-2	~~11-8~~ 11-10
	Douglas fir-larch	#3	~~3-7~~ 3-8	~~5-2~~ 5-4	~~6-7~~ 6-9	~~8-1~~ 8-3	~~9-4~~ 9-7	~~3-4~~ 3-5	~~4-11~~ 5-0	~~6-3~~ 6-4	~~7-7~~ 7-9	~~8-10~~ 9-0
	Hem-Fir	#1	~~4-11~~ 5-0	~~7-2~~ 7-3	~~9-1~~ 9-2	~~11-1~~ 11-3	~~12-10~~ 13-0	~~4-7~~ 4-8	~~6-9~~ 6-10	~~8-7~~ 8-8	~~10-6~~ 10-7	~~12-2~~ 12-4

(Portions of Table not shown remain unchanged)

Reason: Between 1991 and 1997, the standard for deriving sawn lumber design values, ASTM D1990, was slightly revised. As a result, bending design values for sawn lumber were re-calculated which led to slight increases to design values of some grades of certain species. Revised design values for Select Structural, #2, and #3 grades of Douglas fir-Larch and #1 grade of Hem-Fir all increased by 25 psi. Design values in the design value supplements to the 1997 *NDS* and the *Span Tables for Joist & Rafters* were all revised, as were the spans in the 2001 *WFCM* and AWC's on-line span calculator.

It was recently pointed out that span tables incorporated into the 2000 IBC and 2000 IRC were based on span tables pre-dating the revised design values. This proposal revises the IRC span table spans for Select Structural, #2, and #3 grades of Douglas fir-Larch and #1 grade of Hem-Fir using the slightly higher bending values. These spans will be in agreement with current span tables being used by the design community.

Cost Impact: The code change will not increase the cost of construction.

RB248-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.3.1(1)T-RB-PITTS.doc

RB249 – 13
Table R502.3.3(1), Table R502.3.3(2)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLY[a, b, c, f, g, h]
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
a. Tabulated values are for clear-span roof supported solely by exterior bearing walls.
b. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, ~~southern pine~~ and spruce-pine-fir for repetitive (three or more) members.

(Portions of Table not shown remain unchanged)

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY[a, b, e, f]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.
a. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, ~~southern pine~~ and spruce-pine-fir for repetitive (three or more) members.

(Portions of Table not shown remain unchanged)

Reason: It is likely the design values for wider width southern pine lumber will change in early 2013. This proposal will eliminate the use of these tables with southern pine. It is the proponent's intent to find a solution that will allow for the continued use of southern pine with this table, but that will only be possible once the new design values are certified. In the meantime, this change to footnote "b" will prohibit the unintended use of these spans with southern pine lumber.

Cost Impact: The code change will not increase the cost of construction.

RB249-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.3.3(1)T-RB-PITTS.doc

RB250– 13
Table R502.5(1), Table R502.5(2), Table R802.4(1), Table R802.4(2), Table R802.5.1(1) through R802.5.1(8)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R502.5(1)
GIRDER SPANS [a, b] AND HEADER SPANS [a, b] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.
b. No. 1 or better grade lumber shall be used for Southern Pine 2x4s. Other tabulated values assume #2 grade lumber.
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

TABLE R502.5(2)
GIRDER SPANS [a, b] AND HEADER SPANS [a, b] FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches.
b. No. 1 or better grade lumber shall be used for Southern Pine 2x4s. Other tabulated values assume #2 grade lumber.
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

Revise as follows:

TABLE R802.4(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 10 psf, L/∆ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Southern pine	#2	~~12-5~~ 11-10	19-6	25-8	Note a
	Southern pine	#3	~~11-6~~ 9-8	17-0	21-8	25-7
16	Southern pine	#2	~~11-3~~ 10-9	17-8	23-4	Note a
	Southern pine	#3	~~10-0~~ 8-5	14-9	18-9	22-2
19.2	Southern pine	#2	~~10-7~~ 10-2	16-8	21-11	Note a

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
	Southern pine	#3	~~9-1~~ 7-8	13-6	17-2	20-3
24	Southern pine	#2	~~9-10~~ 9-1	15-6	20-1	23-11
	Southern pine	#3	~~8-2~~ 6-10	12-0	15-4	18-1

(Portions of Table not shown remain unchanged)

TABLE R802.4(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2x4	2x6	2x8	2x10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Southern pine	#2	~~9-10~~ 9-1	15-6	20-1	23-11
	Southern pine	#3	~~8-2~~ 6-10	12-0	15-4	18-1
16	Southern pine	#2	~~8-11~~ 7-10	13-6	17-5	20-9
	Southern pine	#3	~~7-1~~ 5-11	10-5	13-3	15-8
19.2	Southern pine	#2	~~8-5~~ 7-2	12-3	15-10	18-11
	Southern pine	#3	~~6-5~~ 5-5	9-6	12-1	14-4
24	Southern pine	#2	~~7-8~~ 6-5	11-0	14-2	16-11
	Southern pine	#3	~~5-9~~ 4-10	8-6	10-10	12-10

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine	#2	~~10-10~~ 10-2	17-0	22-5	Note b	Note b	~~10-6~~ 8-9	15-1	19-5	23-2	Note b
	Southern Pine	#3	~~9-1~~ 7-8	13-6	17-2	20-3	24-1	~~7-11~~ 6-8	11-8	14-10	17-6	20-11
16	Southern Pine	#2	~~9-10~~ 8-9	15-1	19-5	23-2	Note b	~~9-1~~ 7-7	13-0	16-10	20-1	23-7

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
	Southern Pine	#3	~~7-11~~ 6-8	11-8	14-10	17-6	20-11	~~6-10~~ 5-9	10-1	12-10	15-2	18-1
19.2	Southern Pine	#2	~~9-3~~ 8-0	13-9	17-9	21-2	24-10	~~8-4~~ 6-11	11-11	15-4	18-4	21-6
	Southern Pine	#3	~~7-3~~ 6-1	10-8	13-7	16-0	19-1	~~6-3~~ 5-3	9-3	11-9	13-10	16-6
24	Southern Pine	#2	~~8-7~~ 7-2	12-3	15-10	18-11	22-2	~~7-5~~ 6-2	10-8	13-9	16-5	19-3
	Southern Pine	#3	~~6-5~~ 5-5	9-6	12-1	14-4	17-1	~~5-7~~ 4-8	8-3	10-6	12-5	14-9

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling attached to rafters, L/∆ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine	#2	~~9-10~~ 9-5	15-6	20-5	Note b	Note b	~~9-10~~ 8-9	15-1	19-5	23-2	Note b
	Southern Pine	#3	~~9-1~~ 7-8	13-6	17-2	20-3	24-1	~~7-11~~ 6-8	11-8	14-10	17-6	20-11
16	Southern Pine	#2	~~8-11~~ 8-7	14-1	18-6	23-2	Note b	~~8-11~~ 7-7	13-0	16-10	20-1	23-7
	Southern Pine	#3	~~7-11~~ 6-8	11-8	14-10	17-6	20-11	~~6-10~~ 5-9	10-1	12-10	15-2	18-1
19.2	Southern Pine	#2	~~8-5~~ 8-0	13-3	17-5	21-2	24-10	~~8-4~~ 6-11	11-11	15-14	18-4	21-6
	Southern Pine	#3	~~7-3~~ 6-1	10-8	13-7	16-0	19-1	~~6-3~~ 5-3	9-3	11-9	13-10	16-6
24	Southern Pine	#2	~~7-10~~ 7-2	12-3	15-10	18-11	22-2	~~7-5~~ 6-2	10-8	13-9	16-5	19-3
	Southern Pine	#3	~~6-5~~ 5-5	9-6	12-1	14-4	17-1	~~5-7~~ 4-8	8-3	10-6	12-5	14-9

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 30 psf, ceiling not attached to rafters, L/∆ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine	#2	~~9-6~~ 8-5	14-5	18-8	22-3	Note b	~~9-0~~ 7-6	12-11	16-8	19-11	23-4
	Southern Pine	#3	~~7-7~~ 6-4	11-2	14-3	16-10	20-0	~~6-9~~ 5-8	10-0	12-9	15-1	17-11

16	Southern Pine #2	~~8-7~~ 7-3	12-6	16-2	19-3	22-7	~~7-10~~ 6-6	11-2	14-5	17-3	20-2
	Southern Pine #3	~~6-7~~ 5-6	9-8	12-4	14-7	17-4	~~5-10~~ 4-11	8-8	11-0	13-0	15-6
19.2	Southern Pine #2	~~7-11~~ 6-8	11-5	14-9	17-7	20-7	~~7-1~~ 6-0	10-2	13-2	15-9	18-5
	Southern Pine #3	~~6-0~~ 5-0	8-10	11-3	13-4	15-10	~~5-4~~ 4-6	7-11	10-1	11-11	14-2
24	Southern Pine #2	~~7-1~~ 6-0	10-2	13-2	15-9	18-5	~~6-4~~ 5-4	9-2	11-9	14-1	16-6
	Southern Pine #3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~4-9~~ 4-0	7-1	9-0	10-8	12-8

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
		Maximum rafter spans[a]									
		(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine #2	~~8-0~~ 6-10	11-9	15-3	18-2	21-3	~~7-7~~ 6-4	10-11	14-1	16-10	19-9
	Southern Pine #3	~~6-2~~ 5-2	9-2	11-8	13-9	16-4	~~5-9~~ 4-10	8-5	10-9	12-9	15-2
16	Southern Pine #2	~~7-1~~ 6-0	10-2	13-2	15-9	18-5	~~6-7~~ 5-6	9-5	12-2	14-7	17-1
	Southern Pine #3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~4-11~~ 4-2	7-4	9-4	11-0	13-1
19.2	Southern Pine #2	~~6-6~~ 5-5	9-4	12-0	14-4	16-10	~~6-0~~ 5-0	8-8	11-2	13-4	15-7
	Southern Pine #3	~~4-11~~ 4-1	7-3	9-2	10-10	12-11	~~4-6~~ 3-10	6-8	8-6	10-1	12-0
24	Southern Pine #2	~~5-10~~ 4-10	8-4	10-9	12-10	15-1	~~5-5~~ 4-6	7-9	10-0	11-11	13-11
	Southern Pine #3	~~4-4~~ 3-8	6-5	8-3	9-9	11-7	~~4-1~~ 3-5	6-0	7-7	9-0	10-8

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
		Maximum rafter spans[a]									
		(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine #2	~~8-7~~ 8-3	13-6	17-10	22-3	Note b	~~8-7~~ 7-6	12-11	16-8	19-11	23-4
	Southern Pine #3	~~7-7~~ 6-4	11-2	14-3	16-10	20-0	~~6-9~~ 5-8	10-0	12-9	15-1	17-11
16	Southern Pine #2	~~7-10~~ 7-3	12-3	16-2	19-3	22-7	~~7-10~~ 6-6	11-2	14-5	17-3	20-2
	Southern Pine #3	~~6-7~~ 5-6	9-8	12-4	14-7	17-4	~~5-10~~ 4-11	8-8	11-0	13-0	15-6

19.2	Southern Pine #2	~~7-4~~ 6-8	11-5	14-9	17-7	20-7	~~7-1~~ 6-0	10-2	13-2	15-9	18-5
	Southern Pine #3	~~6-0~~ 5-0	8-10	11-3	13-4	15-10	~~5-4~~ 4-6	7-11	10-1	11-11	14-2
24	Southern Pine #2	~~6-10~~ 6-0	10-2	13-2	15-9	18-5	~~6-4~~ 5-4	9-2	11-9	14-1	16-6
	Southern Pine #3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~4-9~~ 4-0	7-1	9-0	10-8	12-8

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
		Maximum rafter spans[a]									
		(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine #2	~~7-3~~ 6-10	11-5	15-0	18-2	21-3	~~7-3~~ 6-4	10-11	14-1	16-10	19-9
	Southern Pine #3	~~6-2~~ 5-2	9-2	11-8	13-9	16-4	~~5-9~~ 4-10	8-5	10-9	12-9	15-2
16	Southern Pine #2	~~6-7~~ 6-0	10-2	13-2	15-9	18-5	~~6-7~~ 5-6	9-5	12-2	14-7	17-1
	Southern Pine #3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~4-11~~ 4-2	7-4	9-4	11-0	13-1
19.2	Southern Pine #2	~~6-2~~ 5-5	9-4	12-0	14-4	16-10	~~6-0~~ 5-0	8-8	11-2	13-4	15-7
	Southern Pine #3	~~4-11~~ 4-1	7-3	9-2	10-10	12-11	~~4-6~~ 3-10	6-8	8-6	10-1	12-0
24	Southern Pine #2	~~5-9~~ 4-10	8-4	10-9	12-10	15-1	~~5-5~~ 4-6	7-9	10-0	11-11	13-11
	Southern Pine #3	~~4-4~~ 3-8	6-5	8-3	9-9	11-7	~~4-1~~ 3-5	6-0	7-7	9-0	10-18

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(7)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
		Maximum rafter spans[a]									
		(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine #2	~~7-1~~ 6-0	10-2	13-2	15-9	18-5	~~6-8~~ 5-7	9-7	12-5	14-10	17-5
	Southern Pine #3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~5-1~~ 4-3	7-5	9-6	11-3	13-4
16	Southern Pine #2	~~6-2~~ 5-2	8-10	11-5	13-7	16-0	~~5-10~~ 4-10	8-4	10-9	12-10	15-1
	Southern Pine #3	~~4-8~~ 3-11	6-10	8-9	10-4	12-3	~~4-4~~ 3-8	6-5	8-3	9-9	11-7
19.2	Southern Pine #2	~~5-7~~ 4-8	8-1	10-5	12-5	14-7	~~5-4~~ 4-5	7-7	9-10	11-9	13-9

	Southern Pine	#3	~~4-3~~ 3-7	6-3	8-0	9-5	11-2	~~4-0~~ 3-4	5-11	7-6	8-10	10-7
24	Southern Pine	#2	~~5-0~~ 4-3	7-3	9-4	11-1	13-0	~~4-9~~ 4-0	6-10	8-9	10-6	12-4
	Southern Pine	#3	~~3-9~~ 3-2	5-7	7-1	8-5	10-0	~~3-7~~ 3-0	5-3	6-9	7-11	9-5

(Portions of Table not shown remain unchanged)

TABLE R802.5.1(8)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, L/∆ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2x4	2x6	2x8	2x10	2x12	2x4	2x6	2x8	2x10	2x12
			Maximum rafter spans[a]									
			(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)	(feet – inches)
12	Southern Pine	#2	~~6-6~~ 6-0	10-2	13-2	15-9	18-5	~~6-6~~ 5-7	9-7	12-5	14-10	17-5
	Southern Pine	#3	~~5-4~~ 4-6	7-11	10-1	11-11	14-2	~~5-1~~ 4-3	7-5	9-6	11-3	13-4
16	Southern Pine	#2	~~5-11~~ 5-2	8-10	11-5	13-7	16-0	~~5-10~~ 4-10	8-4	10-9	12-10	15-1
	Southern Pine	#3	~~4-8~~ 3-11	6-10	8-9	10-4	12-3	~~4-4~~ 3-8	6-5	8-3	9-9	11-7
19.2	Southern Pine	#2	~~5-6~~ 4-8	8-1	10-5	12-5	14-7	~~5-4~~ 4-5	7-7	9-10	11-9	13-9
	Southern Pine	#3	~~4-3~~ 3-7	6-3	8-0	9-5	11-2	~~4-0~~ 3-4	5-11	7-6	8-10	10-7
24	Southern Pine	#2	~~5-0~~ 4-3	7-3	9-4	11-1	13-0	~~4-9~~ 4-0	6-10	8-9	10-6	12-4
	Southern Pine	#3	~~3-9~~ 3-2	5-7	7-1	8-5	10-0	~~3-7~~ 3-0	5-3	6-9	7-11	9-5

(Portions of Table not shown remain unchanged)

Reason: New design values for 2x4 Southern Pine #2 and all lower grades (i.e. #3, Stud, Construction, Standard, and Utility) were certified by the American Lumber Standards Committee Board of Review (BOR) on January 11, 2012, and became effective on June 1, 2012. This proposed change to multiple tables of the IRC reflects lower spans resulting from the newly certified design values. It is anticipated the Board of Review will certify new design values for other widths and grades of southern pine in early 2013. The use of the phrase "no change" is intended to mean that, as of the January 3, 2013 code change deadline, there are no revisions to these table entries. Further, it is likely there will be changes affecting these entries during the time period of the Group B development cycle. If new design values are certified and there is time prior to the IRC Committee hearings, AWC will prepare a floor modification to amend all the affected spans. Alternatively, the revised span tables will be developed for consideration during the Final Action Hearings. Regardless, approval of these spans by the Committee will allow the greatest degree of flexibility to further modify the spans at the Final Action Hearings.

In October 2012, the ICC membership approved code changes S281-12 and S283-12. These changes established a link between changes made to span tables in the IRC to identical IBC span tables. Since design values for wider width southern pine lumber were not available for the IBC Group A development cycle, S281-12 and S283-12 instruct ICC staff to extract the appropriate tables from the 2015 IRC. This will ensure that the 2015 IBC and 2015 IRC have identical state-of-the-art spans for southern pine.

Cost Impact: The code change will not increase the cost of construction.

RB250-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB251 – 13
R502.5, Table R502.5(3) (NEW)

Proponent: Brian Foley, P.E., Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov), Lynn Underwood, Norfolk, VA, representing Virginia Building and Code Officials Association

Revise as follows:

R502.5 Allowable girder and header spans. The allowable spans of girders and headers fabricated of dimension lumber shall not exceed the values set forth in Tables R502.5(1) ~~and~~ through ~~R502.5(2)~~ R502.5(3).

TABLE R502.5(3)
GIRDER AND HEADER SPANS [a] FOR OPEN PORCHES
(Maximum span for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir [b])

SIZE	SUPPORTING ROOF						SUPPORTING FLOOR	
	GROUND SNOW LOAD [c] (psf)							
	30		50		70			
	DEPTH OF PORCH [d] (feet)							
	8	14	8	14	8	14	8	14
2-2 x 6	7-6	5-8	6-2	4-8	5-4	4-0	6-4	4-9
2-2 x 8	10-1	7-7	8-3	6-2	7-1	5-4	8-5	6-4
2-2 x 10	12-4	9-4	10-1	7-7	8-9	6-7	10-4	7-9
2-2 x 12	14-4	10-10	11-8	8-10	10-1	7-8	11-11	9-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa

a. Spans are given in feet and inches.
b. Tabulated values assume #2 grade lumber, wet service and incising for refractory species. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.
c. Porch width is measured horizontally from building face to the centerline of the header. For widths between those shown, spans are permitted to be interpolated.

Reason: The *International Residential Code* (IRC) regulates the size of headers in Chapter 5. Tables R502.5(1) and (2) has categories of building width that begins at 20 feet. Choosing porch header sizes based on those tables would produce oversize sections. To comply, the builder must construct the porch of an oversized header or seek an engineering solution to use the actual header size required.

This code change proposal provides a table based on post construction to support headers for porches with an 8 foot or 14 foot width. The span lengths in the table were based on the 2005 AF&PA/NDS and the species which are commonly identified in other IRC tables similarly to the other span tables in the code.

Cost Impact: The code change proposal will not increase the cost of construction.

RB251-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.5-RB-FOLEY.doc

RB252 – 13

R301.2.2.2.5, R404.1.9.2, R502.5, Table R502.5(1), Table R502.5(2), R602.3, R602.7, Table R602.7.1

Proponent: DD~~D~~ennis Pitts, American Wood Council (dpitts@awc.org)~~)~~

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Revise as follows:

R301.2.2.2.5 Irregular buildings. The seismic provisions of this code shall not be used for irregular structures located in Seismic Design Categories C, D_0, D_1 and D_2. Irregular portions of structures shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. When the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, design of the remainder of the building shall be permitted using the provisions of this code. A building or portion of a building shall be considered to be irregular when one or more of the following conditions occur:

3. When the end of a *braced wall panel* occurs over an opening in the wall below and ends at a horizontal distance greater than 1 foot (305 mm) from the edge of the opening. This provision is applicable to shear walls and *braced wall panels* offset in plane and to *braced wall panels* offset out of plane as permitted by the exception to Item 1 above.

    Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) wide in the wall below provided that the opening includes a header in accordance with the following:

    1. The building width, loading condition and framing member species limitations of Table ~~R502.5(1)~~ R602.7(1) shall apply; and

(Portions of text not shown remain unchanged)

Revise as follows:

R404.1.9.2 Masonry piers supporting floor girders. Masonry piers supporting wood girders sized in accordance with Tables ~~R502.5(1)~~ R602.7(1) and ~~R502.5(2)~~ R602.7(2) shall be permitted in accordance with this section. Piers supporting girders for interior bearing walls shall have a minimum nominal dimension of 12 inches (305 mm) and a maximum height of 10 feet (3048 mm) from top of footing to bottom of sill plate or girder. Piers supporting girders for exterior bearing walls shall have a minimum nominal dimension of 12 inches (305 mm) and a maximum height of 4 feet (1220 mm) from top of footing to bottom of sill plate or girder. Girders and sill plates shall be anchored to the pier or footing in accordance with Section R403.1.6 or Figure R404.1.5(1). Floor girder bearing shall be in accordance with Section R502.6.

Revise as follows:

R502.5 Allowable girder spans. The allowable spans of girders fabricated of dimension lumber shall not exceed the values set forth in ~~Tables R502.5(1) and R502.5(2)~~ Tables R602.7(1) and R602.7(2)

TABLE ~~R502.5(1)~~ R602.7(1)
GIRDER SPANS[a] AND HEADER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)[e]																	
		30						50						70					
		Building width[c] (feet)																	
		20		28		36		20		28		36		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
Roof and ceiling	1-2 × 8	4-6	1	3-10	1	3-5	1	3-9	1	3-2	1	2-10	2	—	—	—	—	—	—
	1-2 × 10	5-8	1	4-11	1	4-4	1	4-9	1	4-1	1	3-7	2	—	—	—	—	—	—
	1-2 × 12	6-11	1	5-11	2	5-3	2	5-9	2	4-8	2	3-8	2	—	—	—	—	—	—
	2-2 × 4	3-6	1	3-2	1	2-10	1	3-2	1	2-9	1	2-6	1	2-10	1	2-6	1	2-3	1
	2-2 × 6	5-5	1	4-8	1	4-2	1	4-8	1	4-1	1	3-8	2	4-2	1	3-8	2	3-3	2
	2-2 × 8	6-10	1	5-11	2	5-4	2	5-11	2	5-2	2	4-7	2	5-4	2	4-7	2	4-1	2
	2-2 × 10	8-5	2	7-3	2	6-6	2	7-3	2	6-3	2	5-7	2	6-6	2	5-7	2	5-0	2
	2-2 × 12	9-9	2	8-5	2	7-6	2	8-5	2	7-3	2	6-6	2	7-6	2	6-6	2	5-10	3
	3-2 × 8	8-4	1	7-5	1	6-8	1	7-5	1	6-5	2	5-9	2	6-8	1	5-9	2	5-2	2
	3-2 × 10	10-6	1	9-1	2	8-2	2	9-1	2	7-10	2	7-0	2	8-2	2	7-0	2	6-4	2
	3-2 × 12	12-2	2	10-7	2	9-5	2	10-7	2	9-2	2	8-2	2	9-5	2	8-2	2	7-4	2
	4-2 × 8	9-2	1	8-4	1	7-8	1	8-4	1	7-5	1	6-8	1	7-8	1	6-8	1	5-11	2
	4-2 × 10	11-8	1	10-6	1	9-5	2	10-6	1	9-1	2	8-2	2	9-5	2	8-2	2	7-3	2
	4-2 × 12	14-1	1	12-2	2	10-11	2	12-2	2	10-7	2	9-5	2	10-11	2	9-5	2	8-5	2
Roof, ceiling and one center-bearing floor	1-2 × 8	3-11	1	3-5	1	3-0	1	3-7	1	3-0	2	2-8	2	—	—	—	—	—	—
	1-2 × 10	5-0	2	4-4	2	3-10	2	4-6	2	3-11	2	3-4	2	—	—	—	—	—	—
	1-2 × 12	5-10	2	4-9	2	4-2	2	5-5	2	4-2	2	3-4	2	—	—	—	—	—	—
	2-2 × 4	3-1	1	2-9	1	2-5	1	2-9	1	2-5	1	2-2	1	2-7	1	2-3	1	2-0	1
	2-2 × 6	4-6	1	4-0	1	3-7	2	4-1	1	3-7	2	3-3	2	3-9	2	3-3	2	2-11	2
	2-2 × 8	5-9	2	5-0	2	4-6	2	5-2	2	4-6	2	4-1	2	4-9	2	4-2	2	3-9	2
	2-2 × 10	7-0	2	6-2	2	5-6	2	6-4	2	5-6	2	5-0	2	5-9	2	5-1	2	4-7	3
	2-2 × 12	8-1	2	7-1	2	6-5	2	7-4	2	6-5	2	5-9	3	6-8	2	5-10	3	5-3	3
	3-2 × 8	7-2	1	6-3	2	5-8	2	6-5	2	5-8	2	5-1	2	5-11	2	5-2	2	4-8	2
	3-2 × 10	8-9	2	7-8	2	6-11	2	7-11	2	6-11	2	6-3	2	7-3	2	6-4	2	5-8	2
	3-2 × 12	10-2	2	8-11	2	8-0	2	9-2	2	8-0	2	7-3	2	8-5	2	7-4	2	6-7	2
	4-2 × 8	8-1	1	7-3	1	6-7	1	7-5	1	6-6	1	5-11	2	6-10	1	6-0	2	5-5	2
	4-2 × 10	10-1	1	8-10	2	8-0	2	9-1	2	8-0	2	7-2	2	8-4	2	7-4	2	6-7	2
	4-2 × 12	11-9	2	10-3	2	9-3	2	10-7	2	9-3	2	8-4	2	9-8	2	8-6	2	7-7	2
Roof, ceiling and one clear span floor	1-2 × 8	3-6	1	3-0	1	2-8	1	3-5	1	2-11	1	2-7	2	—	—	—	—	—	—
	1-2 × 10	4-6	1	3-10	1	3-3	1	4-4	1	3-9	1	3-1	2	—	—	—	—	—	—
	1-2 × 12	5-6	1	4-2	2	3-3	2	5-4	2	3-11	2	3-1	2	—	—	—	—	—	—
	2-2 × 4	2-8	1	2-4	1	2-1	1	2-7	1	2-3	1	2-0	1	2-5	1	2-1	1	1-10	1
	2-2 × 6	3-11	1	3-5	2	3-0	2	3-10	2	3-4	2	3-0	2	3-6	2	3-1	2	2-9	2
	2-2 × 8	5-0	2	4-4	2	3-10	2	4-10	2	4-2	2	3-9	2	4-6	2	3-11	2	3-6	2
	2-2 × 10	6-1	2	5-3	2	4-8	2	5-11	2	5-1	2	4-7	3	5-6	2	4-9	2	4-3	3
	2-2 × 12	7-1	2	6-1	3	5-5	3	6-10	2	5-11	3	5-4	3	6-4	2	5-6	3	5-0	3
	3-2 × 8	6-3	2	5-5	2	4-10	2	6-1	2	5-3	2	4-8	2	5-7	2	4-11	2	4-5	2
	3-2 × 10	7-7	2	6-7	2	5-11	2	7-5	2	6-5	2	5-9	2	6-10	2	6-0	2	5-4	2
	3-2 × 12	8-10	2	7-8	2	6-10	2	8-7	2	7-5	2	6-8	2	7-11	2	6-11	2	6-3	2
	4-2 × 8	7-2	1	6-3	2	5-7	2	7-0	1	6-1	2	5-5	2	6-6	1	5-8	2	5-1	2

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)[e]																	
		30						50						70					
		Building width[c] (feet)																	
		20		28		36		20		28		36		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
	4-2 × 10	8-9	2	7-7	2	6-10	2	8-7	2	7-5	2	6-7	2	7-11	2	6-11	2	6-2	2
	4-2 × 12	10-2	2	8-10	2	7-11	2	9-11	2	8-7	2	7-8	2	9-2	2	8-0	2	7-2	2

(Portion of Table not shown remain unchanged)

TABLE ~~R502.5(2)~~ R602.7(2)
GIRDER SPANS[a] AND HEADER SPANS[a] FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir[b] and required number of jack studs)

(Portions of Table not shown remain unchanged)

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Revise as follows:

R602.3 Design and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, when placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3). Wood structural panel sheathing used for exterior walls shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and Performance Category by a grade mark or certificate of inspection issued by an approved agency and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703.

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Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables ~~R502.5(1)~~ R602.7(1) and ~~R502.5(2)~~ R602.7(2).

R602.7 Headers. For header spans see Tables ~~R502.5(1), R502.5(2), and R602.7.1~~ R602.7(1) and R602.7(2).

~~**TABLE R602.7.1**~~
~~**SPANS FOR MINIMUM No. 2 GRADE SINGLE HEADER[a, b, c, f]**~~

(Portions of Table not shown remain unchanged)

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Reason: This change incorporates the single-ply header table into the main header table. The single-ply header is becoming more common for reasons of energy efficiency.

Single-ply header spans are based on #2 grade Hem-Fir design values, the same basis as the multi-ply headers in the main header table.

It also moves the main header tables back to Chapter 6, the wall chapter, since headers and girders are often considered wall elements and the header tables are commonly referenced in wall provisions. This change should make the tables easier to find since they are more often consulted for headers (walls) than for girders (floors).

The subsections and associated figures on single-ply headers, and the subsection, figure, and table on box headers, remain intact and in the same location.

This change will also facilitate the efficient updating of spans for new lumber design values as they become available.

Cost Impact: The code change will not increase the cost of construction.

RB252-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.5-RB-PITTS.doc

RB253 – 13
R502.6.2, R507.2

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R502.6.2 Joist framing. ~~Joists framing into the side of a wood girder shall be supported by *approved* framing anchors or on ledger strips not less than nominal 2 inches by 2 inches (51 mm by 51 mm).~~ Where floor joists do not bear on the top of supporting wood members, approved connectors shall be used. Connectors shall not transfer gravity loads solely through the bottom half of the supporting beam, girder, or header.

R507.2 Joist framing. Where decks joists do not bear on the top of supporting wood members, approved connectors shall be used. Connectors shall not transfer gravity loads solely through the bottom half of the supporting beam, girder, or header.

Reason: Joist hangers or other framing connections attached solely through the bottom half of beams, girders, or headers can cause splitting failures. The tendency to split increases as the distance between the top fastener and the loaded bottom edge of the member decreases. Correctly designed and installed hangers will be fastened at or near the top edge of members to avoid this splitting failure. Connections below the neutral axis for other than light loads should be avoided (see the *National Design Specification (NDS) for Wood Construction,* Table 11.5.1C, footnote 2).

Cost Impact: The code change will not increase the cost of construction.

RB253-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.6.2 #1-RB-PITTS.doc

RB254 – 13
R502.10

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R502.10 Framing of openings. Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed 4 feet (1219 mm), the header joist may be a single member the same size as the floor joist. Single trimmer joists may be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header. ~~*Approved* hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6 feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).~~

Reason: There is conflicting language in the code regarding the support of framing members at floor openings. R502.10 requires ***header joists*** be provided with approved hangers only when they exceed 6 feet in length and that ***joists*** to be supported on framing anchors or ledger strips only when they are over 12 feet long.

The conflict is that R502.6 requires ***all*** joists, beams, and girders to have not less than 1.5 inches of bearing regardless of length. Applying the existing language literally, a ten foot long joist framed into a stairway opening at one end and into the face of a beam a the other would require a joist hanger where it connects to the beam but not at the stairway header. The loads are assumed to be distributed evenly along the joist. Either the code should require all joists to meet the same requirements or it should exclude all joists 12 feet or less in length from needing hangers. This proposal deletes the language applicable to framing at openings and applies the bearing requirements for all joists as per R502.3. As an aside, the language requiring hangers only for tail joists over 12 feet in length was tracked back to the 1927 *Uniform Building Code*.

For information only:

R502.6 Bearing. The ends of each joist, beam or girder shall have not less than 1.5 inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) on masonry or concrete except where supported on a 1-inch by 4-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjacent stud or by the use of approved joist hangers. The bearing on masonry or concrete shall be direct, or a sill plate of 2-inch-minimum (51 mm) nominal thickness shall be provided under the joist, beam or girder. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 square mm).

Secs. 2506-2507

(g) The minimum permissible thickness of joists, rafters and studs shall be one and five-eights (1 5/8) inches.

(h) Floor joists shall be supported by girders, bearing partitions or exterior walls. Where entering exterior stud walls, the joists shall be supported by a ribbon let into the studs if no plate is provided. Joists shall be well nailed to the supporting studs. Studs shall be doubled under the ends of doubled joists.

(i) Header joists over six (6) feet long and tail joists over twelve (12) feet long shall be hung in approved stirrup irons or joist hangers.

(j) Joists under bearing partitions and running parallel thereto shall be doubled and well spiked or separated by solid bridging not more than sixteen (16) inches on centers to permit the passage of pipes.

(k) Wood cross bridging shall be placed between joists if the span is over eight (8) feet. The distance between bridging or between bridging and bearing shall not exceed eight (8) feet. Wood cross bridging in dwellings may be three (3) inches in cross sectional area, but in other buildings shall not be less than six (6) inches.

Metal cross bridging of equal or greater strength may be used in place of the wood cross bridging.

(l) Between floor joists crossing bearing partitions solid bridging

Cost Impact: The code change proposal will not increase the cost of construction.

RB254-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R502.10-RB-DAVIDSON.doc

RB255 – 13
R503.2.1, R602.3, R604.1, R803.2.1

Proponent: Lisa Reiheld, CSA Group (lisa.reiheld@csagroup.org)

Revise as follows:

R503.2.1 Identification and grade. Wood structural panel sheathing used for structural purposes shall conform to DOC PS 1, DOC PS 2 ~~or, when manufactured in Canada~~, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and Performance Category by a grade *mark* or certificate of inspection issued by an *approved agency*. The Performance Category value shall be used as the "nominal panel thickness" or "panel thickness" whenever referenced in this code.

Revise as follows:

R602.3 Design and construction. Exterior walls of woodframe construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, when placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3). Wood structural panel sheathing used for exterior walls shall conform to DOC PS 1, DOC PS 2 ~~or, when manufactured in Canada~~, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and Performance Category by a grade mark or certificate of inspection issued by an approved agency and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703.

Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables R502.5(1) and R502.5(2).

R604.1 Identification and grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2 or ANSI/APA PRP 210 ~~or, when manufactured in Canada~~, CSA O437 or CSA O325. All panels shall be identified by a grade mark or certificate of inspection issued by an *approved* agency.

Revise as follows:

R803.2.1 Identification and grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2 ~~or, when manufactured in Canada~~, CSA O437 or CSA O325, and shall be identified for grade, bond classification, and Performance Category by a grade mark or certificate of inspection issued by an *approved* agency. Wood structural panels shall comply with the grades specified in Table R503.2.1.1(1).

Reason: The intent should not be specific to what country the product is manufactured in as long as it complies with an accepted standard.

Cost Impact: This code change proposal will not increase the cost of construction.

RB255-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R503.2.1-RB-REIHELD.doc

RB256 – 13
Table R503.2.1.1(1), Chapter 44

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement* and self

Revise as follows:

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT[a,b,c]

j. Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum ¼-inch thick wood panel-type underlayment or fiber-cement underlayment with end and edge joints offset at least 2 inches or 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor or ¾-inch wood finish flooring is installed at right angles to the supports. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span based on deflection of 1/360 of span is 100 psf.

k. Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum ¼-inch thick wood panel-type underlayment or fiber-cement underlayment with end and edge joints offset at least 2 inches or 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor or ¾-inch wood finish flooring is installed at right angles to the supports. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span based on deflection of 1/360 of span is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 44 as follows:

ISO

8336 – Fibre-Cement Flat Sheets – Product Specification and Test Methods

Reason: The current table and footnote clearly limit the allowable type of permitted underlayment to wood, lightweight concrete, approved cellular concrete, or wood finish flooring. The table and footnotes as currently worded restrain trade by prohibiting the use of another approved type of underlayment. The inclusion of a reference to "fiber-cement" clarifies an alternative recognized product permitted in this type of Code-compliant subfloor/underlayment application (see attached ICC-ES ESR-1381 [reference Section 4.3], ESR-2280 [reference Sections 4.2.2.1 and 4.2.3.1], and ESR-2292 [reference Section 4.2]).

IBC Table 722.6.2(4) has, as a result of the Group A IBC Code Hearings, been revised to recognize fiber-cement underlayment in subfloor/underlayment combination. The addition of the new referenced ISO standard and "product category" were also approved during the Group A IBC Code Hearings. This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment by allowing fiber-cement underlayment in subfloor/underlayment combination applications.

Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1288, *Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets*. Fiber-cement producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement products for compliance with ISO 8336. The inclusion of this Standard reference in the IRC will permit manufacturers worldwide to demonstrate product compliance to IRC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade.

Cost Impact: The code change proposal will not increase the cost of construction because the proposed addition of fiber-cement underlayment to the table footnote only provides for the choice and use of a type of underlayment currently used in this type of application and permitted in ICC-ES Evaluation Service Reports.

Analysis: A review of the standard proposed for inclusion in the code, ISO 8336 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB_-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R503.2.1.1(1)T-RB-MULDER.doc

RB257 – 13
Table R503.2.1.1(2), Chapter 44

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement* and Self

Revise as follows:

TABLE R503.2.1.1(2)
ALLOWABLE SPANS FOR SANDED PLYWOOD COMBINATION SUBFLOOR UNDERLAYMENT[a]

a. Plywood continuous over two or more spans and face grain perpendicular to supports. Unsupported edges shall be tongue-and-groove or blocked except where nominal ¼-inch-thick wood panel-type underlayment or fiber-cement underlayment or ¾-inch wood finish floor is used. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span based on deflection of 1/360 of span is 100 psf.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 44 as follows:

ISO

8336 – Fibre-Cement Flat Sheets – Product Specification and Test Methods

Reason: The current table and footnote clearly limit the allowable type of permitted underlayment to wood or wood finished floor. The table and footnote as currently worded restrains trade by prohibiting the use of another approved type of underlayment. The inclusion of a reference to "fiber-cement" clarifies an alternative recognized product permitted in this type of Code-compliant subfloor/underlayment application (see attached ICC-ES ESR-1381 [reference Section 4.3], ESR-2280 [reference Sections 4.2.2.1 and 4.2.3.1], and ESR-2292 [reference Section 4.2]).

IBC Table 722.6.2(4) has, as a result of the Group A IBC Code Hearings, been revised to recognize fiber-cement underlayment in subfloor/underlayment combination. The addition of the new referenced ISO standard and "product category" were also approved during the Group A IBC Code Hearings. This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment by allowing fiber-cement underlayment in subfloor/underlayment combination applications.

Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1288, *Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets*. Fiber-cement producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement products for compliance with ISO 8336. The inclusion of this Standard reference in the IRC will permit manufacturers worldwide to demonstrate product compliance to IRC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade.

Cost Impact: The code change proposal will not increase the cost of construction because the proposed addition of fiber-cement underlayment to the table footnote only provides for the choice and use of a type of underlayment currently used in this type of application and permitted in ICC-ES Evaluation Service Reports.

Analysis: A review of the standard proposed for inclusion in the code, ISO 8336 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

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Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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R505, R505.1, R505.1.1, R505.2, R505.2.1, Figure R505.2(1), Table R505.2(1), Figure R505.2(2), Table R505.2(2), R505.2.2, R505.2.3, Table 505.2.3 (NEW), R505.2.4, Table R505.2.4, R505.2.5, R505.2.5.1, Figure R505.2.5.1, R505.2.5.2, R505.2.5.3, Figure R505.2.5.3, R505.3.1, Table R505.3.1(1), R505.3.2, Table R505.3.2(1), Table R505.3.2(2), Table R505.3.2(3), R505.3.3.1, R505.3.4, Table R505.3.4(1), Table R505.3.4(2), Table R505.3.4(3), Table R505.3.4(4), Figure R505.3.4(2), M1308.1, M2101.6, P2603.2

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Revise as follows:

SECTION R505 COLD-FORMED STEEL FLOOR FRAMING

R505.1 Cold-formed steel floor framing. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel floor framing members shall be in accordance ~~comply~~ with the requirements of this section.

R505.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel floor framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist span, not greater than 40 feet (12 192 mm) in width parallel to the joist span, and less than or equal to three stories above *grade* plane. Cold-formed steel floor framing constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the ultimate design wind speed ~~of 110~~ is less than 139 miles per hour (62~~49~~ m/s), Exposure Category B or C, and ~~a maximum~~ the ground snow load is less than or equal to ~~of~~ 70 pounds per square foot (3.35 kPa).

R505.2 Structural framing. Load-bearing cold-formed steel floor framing members shall be in accordance ~~comply~~ with this section. ~~Figure R505.2(1) and with the dimensional and minimum thickness requirements specified in Tables R505.2(1) and R505.2(2). Tracks shall comply with Figure R505.2(2) and shall have a minimum flange width of 1 1/4 inches (32 mm).~~

R505.2.1 Material. Load-bearing cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of ~~one of the following:~~

~~1. ASTM A 653: Grades 33 and 50 (Class 1 and 3).~~
~~2. ASTM A 792: Grades 33 and 50A.~~
~~3.~~ ASTM A 1003, ~~:~~ Structural Grades 33 Type H and 50 Type H.

FIGURE R505.2.3(1) C-SHAPED SECTION

(Figure remains unchanged)

FIGURE R505.2.3(2) TRACK SECTION

(Figure remains unchanged)

~~**TABLE R505.2(1)**~~
~~**COLD-FORMED STEEL JOIST SIZES**~~

~~MEMBER DESIGNATION[a]~~	~~WEB DEPTH (inches)~~	~~MINIMUM FLANGE WIDTH (inches)~~	~~MAXIMUM FLANGE WIDTH (inches)~~	~~MINIMUM LIP SIZE (inches)~~
~~550S162-t~~	~~5.5~~	~~1.625~~	~~2~~	~~0.5~~
~~800S162-t~~	~~8~~	~~1.625~~	~~2~~	~~0.5~~
~~1000S162-t~~	~~10~~	~~1.625~~	~~2~~	~~0.5~~

~~1200S162-t~~	~~12~~	~~1.625~~	~~2~~	~~0.5~~

~~For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.~~

~~a. The member designation is defined by the first number representing the member depth in 0.01 inch, the letter "S" representing a stud or joist member, the second number representing the flange width in 0.01 inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils [See Table R505.2(2)].~~

TABLE R505.2.3
COLD-FORMED STEEL JOIST SIZES AND THICKNESSES

MEMBER DESIGNATION[a]	WEB DEPTH (inches)	MINIMUM BASE STEEL THICKNESS mil (inches)
550S162-t	5.5	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)
800S162-t	8	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)
1000S162-t	10	43 (0.0428), 54 (0.0538), 68 (0.0677)
1200S162-t	12	43 (0.0428), 54 (0.0538), 68 (0.0677)

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

a. The member designation is defined by the first number representing the member depth in 0.01 inch, the letter "S" representing a stud or joist member, the second number representing the flange width in 0.01 inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils

~~**TABLE R505.2(2)**~~
~~**MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS**~~

~~DESIGNATION THICKNESS (mils)~~	~~MINIMUM BASE STEEL THICKNESS (inches)~~
~~33~~	~~0.0329~~
~~43~~	~~0.0428~~
~~54~~	~~0.0538~~
~~68~~	~~0.0677~~
~~97~~	~~0.0966~~

~~For SI: inch = 25.4 mm, 1 mil = 0.0254 mm.~~

R505.2.2 Corrosion protection. Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.

R505.2.3 Dimension, thickness and material grade. Load-bearing cold-formed steel floor framing members shall comply with Figure R505.2.3(1) and with the dimensional and thickness requirements specified in Table R505.2.3. Additionally, all c-shaped sections shall have a minimum flange width of 1.625 inches (41 mm) and a maximum flange width of 2 inches (51 mm). The minimum lip size for c-shaped sections shall be 0.5 inches (13 mm). Track sections shall comply with Figure R505.2.3(2) and shall have a minimum flange width of $1^1/_4$ inches (32 mm). Minimum Grade 33 ksi steel shall be used wherever 33 mil and 43 mil thicknesses are specified. Minimum Grade 50 ksi steel shall be used wherever 54 and 68 mil thicknesses are specified.

~~**R505.2.2**~~ **R505.2.4 Identification.** Load-bearing cold-formed steel framing members shall have a legible *label*, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.

4. Minimum yield strength, in kips per square inch (ksi) (MPa).

~~**R505.2.3 Corrosion protection.** Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:~~

~~1. A minimum of G 60 in accordance with ASTM A 653.~~
~~2. A minimum of AZ 50 in accordance with ASTM A 792.~~

~~R505.2.4~~ R505.2.5 Fastening ~~requirements~~. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^{1}/_{2}$ inch (12.7 mm), shall be self-drilling tapping, and shall conform to ASTM C 1513. Floor sheathing shall be attached to cold-formed steel joists with minimum No. 8 self-drilling tapping screws that conform to ASTM C 1513. Screws attaching floor-sheathing to cold-formed steel joists shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^{3}/_{8}$ inch (9.5 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C 954 or ASTM C 1513 with a bugle head style and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel a minimum of three exposed threads. All fasteners shall have rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

~~Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in Table R505.2.4 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84 mm). When applying the reduction factor, the resulting number of screws shall be rounded up.~~

~~TABLE R505.2.4~~
~~SCREW SUBSTITUTION FACTOR~~

~~SCREW SIZE~~	~~THINNEST CONNECTED STEEL SHEET (mils)~~	
	~~33~~	~~43~~
~~#8~~	~~1.0~~	~~0.67~~
~~#10~~	~~0.93~~	~~0.62~~
~~#12~~	~~0.86~~	~~0.56~~

~~For SI: 1 mil = 0.0254 mm.~~

~~R505.2.5~~ R505.2.6 Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing, and web hole patching shall be in accordance with this section.

~~R505.2.5.1~~ R505.2.6.1 Web holes. Web holes in floor joists shall comply with all of the following conditions:

1. Holes shall conform to Figure ~~R505.2.5.1~~ R505.2.6.1;
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Holes shall have a center-to-center spacing of not less than 24 inches (610 mm);
4. Holes shall have a web hole width not greater than 0.5 times the member depth, or $2^{1}/_{2}$ inches (64.5 mm);
5. Holes shall have a web hole length not exceeding $4^{1}/_{2}$ inches (114 mm); and
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section ~~R505.2.5.2~~ R505.2.6.2, patched in accordance with Section ~~R505.2.5.3~~ R505.2.6.3 or designed in accordance with accepted engineering practices.

FIGURE ~~R505.2.5.1~~ R505.2.6.1 FLOOR JOIST WEB HOLES

(Figure remains unchanged)

~~R505.2.5.2~~ R505.2.6.2 Web hole reinforcing. Reinforcement of web holes in floor joists not conforming to the requirements of Section ~~R505.2.5.1~~ R505.2.6.1 shall be permitted if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shape section with a hole that does not exceed the web hole size limitations of Section ~~R505.2.5.1~~ R505.2.6.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel reinforcing shall be fastened to the web of the receiving member with No. 8 screws spaced no more than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (12.7 mm).

~~R505.2.5.3~~ R505.2.6.3 Hole patching. Patching of web holes in floor joists not conforming to the requirements in Section ~~R505.2.5.1~~ R505.2.6.1 shall be permitted in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practices where web holes exceed the following size limits:
   1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or
   1.2. The length of the hole measured along the web, exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section ~~R505.2.5.3~~ R505.2.6.3, Item 1, shall be patched with a solid steel plate, stud section, or track section in accordance with Figure ~~R505.2.5.3~~ R505.2.6.3. The steel patch shall, as a minimum, be of the same thickness as the receiving member and shall extend at least 1 inch (25 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced no more than 1 inch (25 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (13 mm).

FIGURE ~~R505.2.5.3~~ R505.2.6.3
FLOOR JOIST WEB HOLE PATCH

(Figure remains unchanged)

R505.3.1 Floor to foundation or load-bearing wall connections. Cold-formed steel framed floors shall be anchored to foundations, wood sills or load-bearing walls in accordance with Table R505.3.1(1) and Figure R505.3.1(1), R505.3.1(2), R505.3.1(3), R505.3.1(4), R505.3.1(5) or R505.3.1(6). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Continuous cold-formed steel joists supported by interior load-bearing walls shall be constructed in accordance with Figure R505.3.1(7). Lapped cold-formed steel joists shall be constructed in accordance with Figure R505.3.1(8). End floor joists constructed on foundation walls parallel to the joist span shall be doubled unless a C-shaped bearing stiffener, sized in accordance with Section R505.3.4, is installed web-to-web with the floor joist beneath each supported wall stud, as shown in Figure R505.3.1(9). Fastening of cold-formed steel joists to other framing members shall be in accordance with Section ~~R505.2.4~~ R505.2.5 and Table R505.3.1(2).

TABLE R505.3.1(1)
FLOOR TO FOUNDATION OR BEARING WALL CONNECTION REQUIREMENTS[a, b]

FRAMING CONDITION	BASIC ULTIMATE WIND SPEED (mph) AND EXPOSURE	
	~~85~~110 mph Exposure Category C or less than ~~110~~139 mph Exposure Category B	Less than ~~110~~139 mph Exposure Category C
Floor joist to wall track of exterior wall per Figure R505.3.1(1)	2-No. 8 screws	3-No. 8 screws
Rim track or end joist to load-bearing wall top track per Figure R505.3.1(1)	1-No. 8 screw at 24 inches o.c.	1-No. 8 screw at 24 inches o.c.
Rim track or end joist to wood sill per Figure R505.3.1(2)	Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails
Rim track or end joist to foundation per Figure R505.3.1(3)	$^1/_2$ inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws	$^1/_2$ inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws
Cantilevered joist to foundation per Figure R505.3.1(4)	$^1/_2$ inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws	$^1/_2$ inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws
Cantilevered joist to wood sill per Figure R505.3.1(5)	Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails
Cantilevered joist to exterior load-bearing wall track per Figure R505.3.1(6)	2-No. 8 screws	3-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour – 0.447 m/s, 1 foot – 304.8 mm.

a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks (e.g, at door openings or corners). Bolts extend a minimum of 15 inches into masonry or 7 inches into concrete. Anchor bolts connecting cold-formed steel framing to the foundation structure are to be installed so that the distance from the center of the bolt hole to the edge of the connected member is not less than one and one-half bolt diameters.
b. All screw sizes shown are minimum.

R505.3.2 Minimum floor joist sizes. Floor joist size and thickness shall be determined in accordance with the limits set forth in Table R505.3.2~~(1)~~ for single or continuous spans ~~and Tables R505.3.2(2) and R505.3.2(3) for multiple spans.~~ When continuous joist members are used, the interior bearing supports shall be located within 2 feet (610 mm) of mid-span of the cold-formed steel joists, and the individual spans shall not exceed the spans in Table ~~R505.3.2(2) or R505.3.2(3), as applicable~~ R505.3.2. Floor joists shall have a bearing support length of not less than $1^1/_2$ inches (38 mm) for exterior wall supports and $3^1/_2$ inches (89 mm) for interior wall supports. Tracks shall be a minimum of 33 mils (0.84 mm) thick except when used as part of a floor header or trimmer in accordance with Section R505.3.8. Bearing stiffeners shall be installed in accordance with Section R505.3.4.

TABLE R505.3.2~~(1)~~
ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS—
SINGLE OR CONTINUOUS SPANS[a, b, c, d, e]
~~**33 ksi STEEL**~~

JOIST DESIGNATION	30 PSF LIVE LOAD				40 PSF LIVE LOAD			
	Spacing (inches)				Spacing (inches)			
	12	16	19.2	24	12	16	19.2	24
550S162-33	11′-7″	10′-7″	9′-6″	8′-6″	10′-7″	9′-3″	8′-6″	7′-6″
550S162-43	12′-8″	11′-6″	10′-10″	10′-2″	11′-6″	10′-5″	9′-10″	9′-1″
550S162-54	13′-7″	12′-4″	11′-7″	10′-9″	12′-4″	11′-2″	10′-6″	9′-9″
550S162-68	14′-7″	13′-3″	12′-6″	11′-7″	13′-3″	12′-0″	11′-4″	10′-6″
~~550S162-97~~	~~16′-2″~~	~~14′-9″~~	~~13′-10″~~	~~12′-10″~~	~~14′-9″~~	~~13′-4″~~	~~12′-7″~~	~~11′-8″~~
800S162-33	15′-8″	13′-11″	12′-9″	11′-5″	14′-3″	12′-5″	11′-3″	9′-0″
800S162-43	17′-1″	15′-6″	14′-7″	13′-7″	15′-6″	14′-1″	13′-3″	12′-4″
800S162-54	18′-4″	16′-8″	15′-8″	14′-7″	16′-8″	15′-2″	14′-3″	13′-3″
800S162-68	19′-9″	17′-11″	16′-10″	15′-8″	17′-11″	16′-3″	15′-4″	14′-2″
~~800S162-97~~	~~22′-0″~~	~~20′-0″~~	~~16′-10″~~	~~17′-5″~~	~~20′-0″~~	~~18′-2″~~	~~17′-1″~~	~~15′-10″~~
1000S162-43	20′-6″	18′-8″	17′-6″	15′-8″	18′-8″	16′-11″	15′-6″	13′-11″
1000S162-54	22′-1″	20′-0″	18′-10″	17′-6″	20′-0″	18′-2″	17′-2″	15′-11″
1000S162-68	23′-9″	21′-7″	20′-3″	18′-10″	21′-7″	19′-7″	18′-5″	17′-1″
~~1000S162-97~~	~~26′-6″~~	~~24′-1″~~	~~22′-8″~~	~~21′-0″~~	~~24′-1″~~	~~21′-10″~~	~~20′-7″~~	~~19′-1″~~
1200S162-43	23′-9″	20′-10″	19′-0″	16′-8″	21′-5″	18′-6″	16′-6″	13′-2″
1200S162-54	25′-9″	23′-4″	22′-0″	20′-1″	23′-4″	21′-3″	20′-0″	17′-10″
1200S162-68	27′-8″	25′-1″	23′-8″	21′-11″	25′-1″	22′-10″	21′-6″	21′-1″
~~1200S162-97~~	~~30′-11″~~	~~28′-1″~~	~~26′-5″~~	~~24′-6″~~	~~28′-1″~~	~~25′-6″~~	~~24′-0″~~	~~22′-3″~~

For SI: 1 inch – 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criteria: *L*/480 for live loads, *L*/240 for total loads.
b. Floor dead load – 10 psf.
c. Table provides the maximum clear span in feet and inches.
d. Bearing stiffeners are to be installed at all support points and concentrated loads.
e. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~**TABLE R505.3.2(2)**~~
~~**ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS—MULTIPLE SPANS[a, b, c, d, e, f] 33 ksi STEEL**~~

~~JOIST DESIGNATION~~	~~30 PSF LIVE LOAD~~				~~40 PSF LIVE LOAD~~			
	~~Spacing (inches)~~				~~Spacing (inches)~~			
	~~12~~	~~16~~	~~19.2~~	~~24~~	~~12~~	~~16~~	~~19.2~~	~~24~~
~~550S162-33~~	~~12′-1″~~	~~10′-5″~~	~~9′-6″~~	~~8′-6″~~	~~10′-9″~~	~~9′-3″~~	~~8′-6″~~	~~7′-6″~~
~~550S162-43~~	~~14′-5″~~	~~12′-5″~~	~~11′-4″~~	~~10′-2″~~	~~12′-9″~~	~~11′-11″~~	~~10′-1″~~	~~9′-0″~~
~~550S162-54~~	~~16′-3″~~	~~14′-1″~~	~~12′-10″~~	~~11′-6″~~	~~14′-5″~~	~~12′-6″~~	~~11′-5″~~	~~10′-2″~~
~~550S162-68~~	~~19′-7″~~	~~17′-9″~~	~~16′-9″~~	~~15′-6″~~	~~17′-9″~~	~~16′-2″~~	~~15′-2″~~	~~14′-1″~~
~~550S162-97~~	~~21′-9″~~	~~19′-9″~~	~~18′-7″~~	~~17′-3″~~	~~19′-9″~~	~~17′-11″~~	~~16′-10″~~	~~15′-4″~~
~~800S162-33~~	~~14′-8″~~	~~11′-10″~~	~~10′-4″~~	~~8′-8″~~	~~12′-4″~~	~~9′-11″~~	~~8′-7″~~	~~7′-2″~~
~~800S162-43~~	~~20′-0″~~	~~17′-4″~~	~~15′-9″~~	~~14′-1″~~	~~17′-9″~~	~~15′-4″~~	~~14′-0″~~	~~12′-0″~~
~~800S162-54~~	~~23′-7″~~	~~20′-5″~~	~~18′-8″~~	~~16′-8″~~	~~21′-0″~~	~~18′-2″~~	~~16′-7″~~	~~14′-10″~~
~~800S162-68~~	~~26′-5″~~	~~23′-1″~~	~~21′-0″~~	~~18′-10″~~	~~23′-8″~~	~~20′-6″~~	~~18′-8″~~	~~16′-9″~~
~~800S162-97~~	~~29′-6″~~	~~26′-10″~~	~~25′-3″~~	~~22′-8″~~	~~26′-10″~~	~~24′-4″~~	~~22′-6″~~	~~20′-2″~~
~~1000S162-43~~	~~22′-2″~~	~~18′-3″~~	~~16′-0″~~	~~13′-7″~~	~~18′-11″~~	~~15′-5″~~	~~13′-6″~~	~~11′-5″~~

~~1000S162-54~~	~~26′-2″~~	~~22′-8″~~	~~20′-8″~~	~~18′-6″~~	~~23′-3″~~	~~20′-2″~~	~~18′-5″~~	~~16′-5″~~
~~1000S162-68~~	~~31′-5″~~	~~27′-2″~~	~~24′-10″~~	~~22′-2″~~	~~27′-11″~~	~~24′-2″~~	~~22′-1″~~	~~19′-9″~~
~~1000S162-97~~	~~35′-6″~~	~~32′-3″~~	~~29′-11″~~	~~26′-9″~~	~~32′-3″~~	~~29′-2″~~	~~26′-7″~~	~~23′-9″~~
~~1200S162-43~~	~~21′-8″~~	~~17′-6″~~	~~15′-3″~~	~~12′-10″~~	~~18′-3″~~	~~14′-8″~~	~~12′-8″~~	~~10′-6"~~
~~1200S162-54~~	~~28′-5″~~	~~24′-8″~~	~~22′-6″~~	~~19′-6″~~	~~25′-3″~~	~~21′-11″~~	~~19′-4″~~	~~16′-6″~~
~~1200S162-68~~	~~33′-7″~~	~~29′-1″~~	~~26′-6″~~	~~23′-9″~~	~~29′-10″~~	~~25′-10″~~	~~23′-7″~~	~~21′-1″~~
~~1200S162-97~~	~~41′-5″~~	~~37′-8″~~	~~34′-6″~~	~~30′-10″~~	~~37′-8″~~	~~33′-6″~~	~~30′-7″~~	~~27′-5″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criteria: *L*/480 for live loads, *L*/240 for total loads.~~
~~b. Floor dead load = 10 psf.~~
~~c. Table provides the maximum clear span in feet and inches to either side of the interior support.~~
~~d. Interior bearing supports for multiple span joists consist of structural (bearing) walls or beams.~~
~~e. Bearing stiffeners are to be installed at all support points and concentrated loads.~~
~~f. Interior supports shall be located within 2 feet of mid-span provided that each of the resulting span does not exceed the appropriate maximum span shown in the table above.~~

~~TABLE R505.3.2(3)~~
~~ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS—MULTIPLE SPANS[a, b, c, d, e, f] 50 ksi STEEL~~

~~JOIST DESIGNATION~~	~~30 PSF LIVE LOAD Spacing (inches)~~				~~40 PSF LIVE LOAD Spacing (inches)~~			
	~~12~~	~~16~~	~~19.2~~	~~24~~	~~12~~	~~16~~	~~19.2~~	~~24~~
~~550S162-33~~	~~13′-11″~~	~~12′-0″~~	~~11′-0″~~	~~9′-3″~~	~~12′-3″~~	~~10′-8″~~	~~9′-7″~~	~~8′-4″~~
~~550S162-43~~	~~16′-3″~~	~~14′-1″~~	~~12′-10″~~	~~11′-6″~~	~~14′-6″~~	~~12′-6″~~	~~11′-5″~~	~~10′-3″~~
~~550S162-54~~	~~18′-2″~~	~~16′-6″~~	~~15′-4″~~	~~13′-8″~~	~~16′-6″~~	~~14′-11″~~	~~13′-7″~~	~~12′-2″~~
~~550S162-68~~	~~19′-6″~~	~~17′-9″~~	~~16′-8″~~	~~15′-6″~~	~~17′-9″~~	~~16′-1″~~	~~15′-2″~~	~~14′-0″~~
~~550S162-97~~	~~21′-9″~~	~~19′-9″~~	~~18′-6″~~	~~17′-2″~~	~~19′-8″~~	~~17′-10″~~	~~16′-8″~~	~~15′-8″~~
~~800S162-33~~	~~15′-6″~~	~~12′-6″~~	~~10′-10″~~	~~9′-1″~~	~~13′-0″~~	~~10′-5″~~	~~8′-11″~~	~~6′-9″~~
~~800S162-43~~	~~22′-0″~~	~~19′-1″~~	~~17′-5″~~	~~15′-0″~~	~~19′-7″~~	~~16′-11″~~	~~14′-10″~~	~~12′-8″~~
~~800S162-54~~	~~24′-6″~~	~~22′-4″~~	~~20′-6″~~	~~17′-11″~~	~~22′-5″~~	~~19′-9″~~	~~17′-11″~~	~~15′-10″~~
~~800S162-68~~	~~26′-6″~~	~~24′-1″~~	~~22′-8″~~	~~21′-0″~~	~~24′-1″~~	~~21′-10″~~	~~20′-7″~~	~~19′-2″~~
~~800S162-97~~	~~29′-9″~~	~~26′-8″~~	~~25′-2″~~	~~23′-5″~~	~~26′-8″~~	~~24′-3″~~	~~22′-11″~~	~~21′-4″~~
~~1000S162-43~~	~~23′-6″~~	~~19′-2″~~	~~16′-9″~~	~~14′-2″~~	~~19′-11″~~	~~16′-2″~~	~~14′-0″~~	~~11′-9″~~
~~1000S162-54~~	~~28′-2″~~	~~23′-10″~~	~~21′-7″~~	~~18′-11″~~	~~24′-8″~~	~~20′-11″~~	~~18′-9″~~	~~18′-4″~~
~~1000S162-68~~	~~31′-10″~~	~~28′-11″~~	~~27′-2″~~	~~25′-3″~~	~~28′-11″~~	~~26′-3″~~	~~24′-9″~~	~~22′-9″~~
~~1000S162-97~~	~~35′-4″~~	~~32′-1″~~	~~30′-3″~~	~~28′-1″~~	~~32′-1″~~	~~29′-2″~~	~~27′-6″~~	~~25′-6″~~
~~1200S162-43~~	~~22′-11″~~	~~18′-5″~~	~~16′-0″~~	~~13′-4″~~	~~19′-2″~~	~~15′-4″~~	~~13′-2″~~	~~10′-6″~~
~~1200S162-54~~	~~32′-8″~~	~~28′-1″~~	~~24′-9″~~	~~21′-2″~~	~~29′-0″~~	~~23′-10″~~	~~20′-11″~~	~~17′-9″~~
~~1200S162-68~~	~~37′-1″~~	~~32′-5″~~	~~29′-4″~~	~~25′-10″~~	~~33′-4″~~	~~28′-6″~~	~~25′-9″~~	~~22′-7″~~
~~1200S162-97~~	~~41′-2″~~	~~37′-6″~~	~~35′-3″~~	~~32′-9″~~	~~37′-6″~~	~~34′-1″~~	~~32′-1″~~	~~29′-9″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criteria: *L*/480 for live loads, *L*/240 for total loads.~~
~~b. Floor dead load = 10 psf.~~
~~c. Table provides the maximum clear span in feet and inches to either side of the interior support.~~
~~d. Interior bearing supports for multiple span joists consist of structural (bearing) walls or beams.~~
~~e. Bearing stiffeners are to be installed at all support points and concentrated loads.~~
~~f. Interior supports shall be located within 2 feet of mid-span provided that each of the resulting span does not exceed the appropriate maximum span shown in the table above.~~

R505.3.3.1 Joist top flange bracing. The top flanges of cold-formed steel joists shall be laterally braced by the application of floor sheathing fastened to the joists in accordance with Section ~~R505.2.4~~ R505.2.5 and Table R505.3.1(2).

R505.3.4 Bearing stiffeners. Bearing stiffeners shall be installed at each joist bearing location in accordance with this section, except for joists lapped over an interior support not carrying a load-bearing wall above. Floor joists supporting jamb studs with multiple members shall have two bearing stiffeners in accordance with Figure R505.3.4(1). Bearing stiffeners shall be fabricated from a C-shaped, track or clip angle member in accordance with the one of following:

1. C-shaped bearing stiffeners:
   1.1. Where the joist is not carrying a load-bearing wall above, the bearing stiffener shall be a minimum 33 mil (0.84 mm) thickness.
   1.2. Where the joist is carrying a load-bearing wall above, the bearing stiffener shall be at least the same designation thickness as the wall stud above.
2. Track bearing stiffeners:
   2.1. Where the joist is not carrying a load-bearing wall above, the bearing stiffener shall be a minimum 43 mil (1.09 mm) thickness.
   2.2. Where the joist is carrying a load-bearing wall above, the bearing stiffener shall be at least one designation thickness greater than the wall stud above.
3. ~~Clip angle bearing stiffeners: Where the clip angle bearing stiffener is fastened to both the web of the member it is stiffening and an adjacent rim track using the fastener pattern shown in Figure R505.3.4(2), the bearing stiffener shall be a minimum 2 inch by 2 inch (51 mm by 51 mm) angle sized in accordance with Tables R505.3.4(1), R505.3.4(2), R505.3.4(3), and R505.3.4(4).~~

The minimum length of a bearing stiffener shall be the depth of member being stiffened minus $^3/_8$ inch (9.5 mm). Each bearing stiffener shall be fastened to the web of the member it is stiffening as shown in Figure R505.3.4(2). ~~Each clip angle bearing stiffener shall also be fastened to the web of the adjacent rim track using the fastener pattern shown in Figure R505.3.4(2)~~. No. 8 screws shall be used for C-shaped and track members of any thickness~~ and for clip angle members with a designation thickness less than or equal to 54. No. 10 screws shall be used for clip angle members with a designation thickness greater than 54~~.

~~TABLE R505.3.4(1)~~
~~CLIP ANGLE BEARING STIFFENERS~~
~~(20 psf equivalent snow load)~~

~~JOIST DESIGNATION~~	~~MINIMUM THICKNESS (mils) OF 2-INCH × 2-INCH (51 mm × 51 mm) CLIP ANGLE~~											
	~~Top floor~~				~~Bottom floor in 2 story Middle floor in 3 story~~				~~Bottom floor in 3 story~~			
	~~Joist spacing (inches)~~				~~Joist spacing (inches)~~				~~Joist spacing (inches)~~			
	~~12~~	~~16~~	~~19.2~~	~~24~~	~~12~~	~~16~~	~~19.2~~	~~24~~	~~12~~	~~16~~	~~19.2~~	~~24~~
~~800S162-33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	—
~~800S162-43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~54~~	~~68~~	~~68~~	~~97~~	~~97~~	~~97~~	~~97~~
~~800S162-54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	—
~~800S162-68~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~54~~	~~97~~	~~97~~	—
~~800S162-97~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~97~~
~~1000S162-43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~97~~	~~97~~	~~97~~	—	—	—
~~1000S162-54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~68~~	~~97~~	~~97~~	~~97~~	—	—
~~1000S162-68~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~97~~	~~97~~	~~97~~	—	—	—
~~1000S162-97~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~68~~	~~97~~	—
~~1200S162-43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—
~~1200S162-54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—
~~1200S162-68~~	~~43~~	~~43~~	~~54~~	~~54~~	~~68~~	~~97~~	~~97~~	~~97~~	—	—	—	—
~~1200S162-97~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~97~~	~~97~~	—	—	—

~~For SI: 1 mil = 0.254 mm, 1 inch = 25.4 mm, 1 pound per square foot = 0.0479~~

TABLE R505.3.4(2)
CLIP ANGLE BEARING STIFFENERS
(30 psf equivalent snow load)

JOIST DESIGNATION	MINIMUM THICKNESS (mils) OF 2-INCH × 2 INCH (51 mm × 51 mm) CLIP ANGLE											
	Top floor				Bottom floor in 2 story Middle floor in 3 story				Bottom floor in 3 story			
	Joist spacing (inches)				Joist spacing (inches)				Joist spacing (inches)			
	12	16	19.2	24	12	16	19.2	24	12	16	19.2	24
800S162-33	43	43	43	43	54	68	68	97	97	97	97	—
800S162-43	43	43	43	54	68	68	68	97	97	97	97	—
800S162-54	43	43	43	43	54	68	68	97	97	97	—	—
800S162-68	43	43	43	43	43	54	68	97	68	97	97	—
800S162-97	43	43	43	43	43	43	43	43	43	43	68	97
1000S162-43	54	54	54	54	68	97	97	97	97	—	—	—
1000S162-54	54	54	54	54	68	97	97	97	97	—	—	—
1000S162-68	43	43	54	68	68	97	97	—	97	—	—	—
1000S162-97	43	43	43	43	43	43	54	68	54	97	—	—
1200S162-43	54	68	68	68	97	97	97	—	—	—	—	—
1200S162-54	68	68	68	68	97	97	—	—	—	—	—	—
1200S162-68	68	68	68	68	97	97	97	—	—	—	—	—
1200S162-97	43	43	43	43	54	68	97	—	97	—	—	—

For SI: 1 mil = 0.254 mm, 1 inch = 25.4 mm, 1 pound per square foot = 0.0479

TABLE R505.3.4(3)
CLIP ANGLE BEARING STIFFENERS (50 psf equivalent snow load)

JOIST DESIGNATION	MINIMUM THICKNESS (mils) OF 2-INCH × 2-INCH (51 mm × 51 mm) CLIP ANGLE											
	Top floor				Bottom floor in 2 story Middle floor in 3 story				Bottom floor in 3 story			
	Joist spacing (inches)				Joist spacing (inches)				Joist spacing (inches)			
	12	16	19.2	24	12	16	19.2	24	12	16	19.2	24
800S162-33	54	54	54	54	68	97	97	97	97	—	—	—
800S162-43	68	68	68	68	97	97	97	97	—	—	—	—
800S162-54	54	68	68	68	97	97	97	97	—	—	—	—
800S162-68	43	43	54	54	68	97	97	97	97	—	—	—
800S162-97	43	43	43	43	43	43	43	54	54	68	97	—
1000S162-43	97	68	68	68	97	97	97	97	—	—	—	—
1000S162-54	97	97	68	68	97	97	97	—	—	—	—	—
1000S162-68	68	97	97	97	97	—	—	—	—	—	—	—
1000S162-97	43	43	43	43	54	68	97	97	—	—	—	—
1200S162-43	97	97	97	97	—	—	—	—	—	—	—	—
1200S162-54	—	97	97	97	—	—	—	—	—	—	—	—
1200S162-68	97	97	97	97	—	—	—	—	—	—	—	—
1200S162-97	54	68	68	97	97	—	—	—	—	—	—	—

For SI: 1 mil = 0.254 mm, 1 inch = 25.4 mm, 1 pound per square foot = 0.0479

~~TABLE R505.3.4(4)~~
~~CLIP ANGLE BEARING STIFFENERS~~
~~(70 psf equivalent snow load)~~

~~JOIST DESIGNATION~~	**~~MINIMUM THICKNESS (mils) OF 2-INCH × 2-INCH (51 mm × 51 mm) CLIP ANGLE~~**											
	~~Top floor~~				**~~Bottom floor in 2 story Middle floor in 3 story~~**				**~~Bottom floor in 3 story~~**			
	~~Joist spacing (inches)~~				**~~Joist spacing (inches)~~**				**~~Joist spacing (inches)~~**			
	~~12~~	**~~16~~**	**~~19.2~~**	**~~24~~**	**~~12~~**	**~~16~~**	**~~19.2~~**	**~~24~~**	**~~12~~**	**~~16~~**	**~~19.2~~**	**~~24~~**
~~800S162-33~~	~~68~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—
~~800S162-43~~	~~97~~	~~97~~	~~97~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—
~~800S162-54~~	~~97~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—	—	—
~~800S162-68~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—
~~800S162-97~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~	~~68~~	~~97~~	~~97~~	~~97~~	—	—
~~1000S162-43~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—	—	—	—
~~1000S162-54~~	—	~~97~~	~~97~~	~~97~~	—	—	—	—	—	—	—	—
~~1000S162-68~~	~~97~~	~~97~~	—	—	—	—	—	—	—	—	—	—
~~1000S162-97~~	~~68~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	—	—	—	—	—	—
~~1200S162-43~~	~~97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—	—	—	—
~~1200S162-54~~	—	—	—	—	—	—	—	—	—	—	—	—
~~1200S162-68~~	—	—	—	—	—	—	—	—	—	—	—	—
~~1200S162-97~~	~~97~~	~~97~~	~~97~~	—	—	—	—	—	—	—	—	—

~~For SI: 1 mil 0.0254 mm, 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.~~

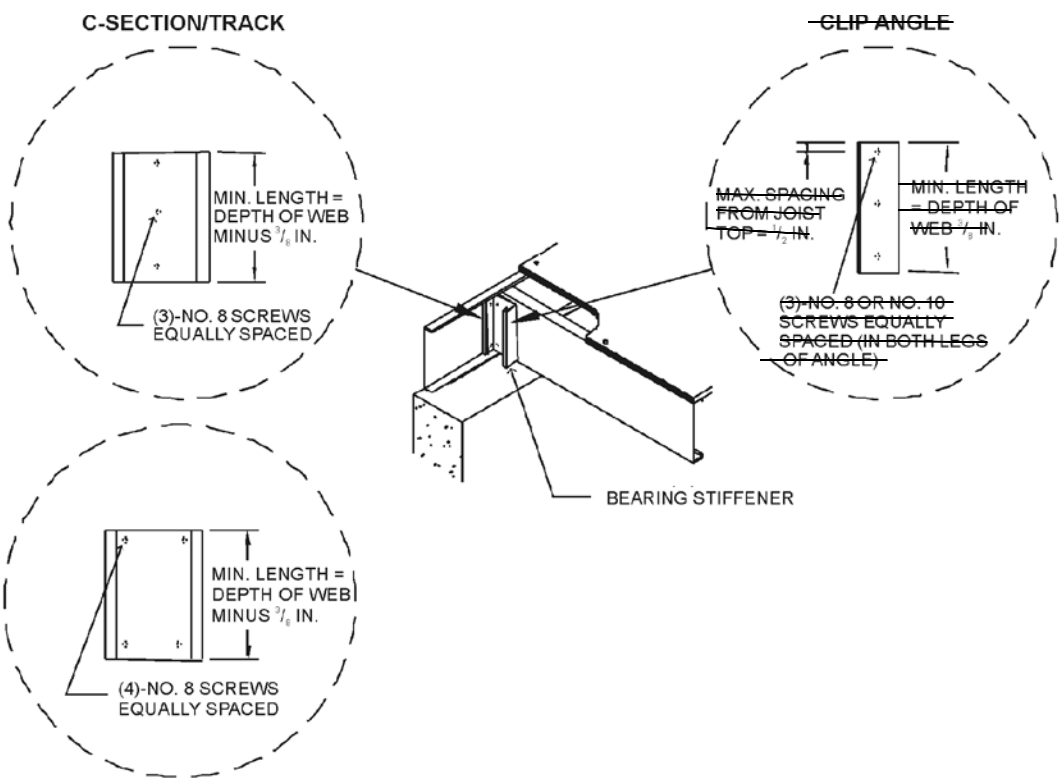


FIGURE R505.3.4(2)
BEARING STIFFENER

Revise as follows:

M1308.1 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections ~~R505.2.5~~ <u>R505.2.6</u>, R603.2.5 and R804.2.5. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Revise as follows:

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections ~~R505.2.5~~ <u>R505.2.6</u>, R603.2.5 and R804.2.5. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.

Revise as follows:

P2603.2 Drilling and notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in Sections R502.8, R602.6, R802.7 and R802.7.1. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections ~~R505.2.5~~ <u>R505.2.6</u>, R603.2.5 and R804.2.5. In accordance with the provisions in Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Reason: This proposal is one in a series intended to both update and streamline the cold-formed steel (CFS) light frame construction provisions of the IRC. The revisions are based upon recommendations made by the AISI Committee on Framing Standards (COFS) Prescriptive Methods Subcommittee, which is responsible for the requirements' base document -- AISI S230, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings.* For the most part, the changes are editorial in nature and work to focus the cold-formed steel solutions presented in the IRC on the most popular and readily available options. The changes also align the cold-formed steel provisions with the latest reference standards, including AISI S230-07 w/S3-12, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings,* 2007, with Supplement 3, 2012.

Changes specific to Section R505 include the following:

- **R505:** Title correction.
- **R505.1**: The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial adjustments are made to the language. The design wind speeds are changed based upon the following direct conversion table, which was incorporated into AISI S230-07 w/S3-12:

ASCE 7-10 Wind Speed (mph)	110	115	126	139	152	164	177	190
AISI S230 Wind Speed (mph)	85	90	100	110	120	130	140	150

- **R505.2:** Requirements are relocated to new Section R505.2.3, which is specific to dimension, thickness and material grade.
- **R505.2.1:** The references to ASTM A653 and ASTM A792 are deleted. Since these materials are included under ASTM A1003, they do not need to be repeated in this section.
- **R505.2.2:** The corrosion protection requirements are relocated from Section R505.2.3 for better flow in section.
- **R505.2.3:** Requirements from Section R505.2 are relocated into new section on dimension, thickness and material grade and Table R505.2(1) and Table R505.2(2) are combined into new Table R505.2.3. The minimum flange width, maximum flange width, and minimum lip size are moved into the charging language for the table, since these properties do not vary based upon the member designation. Also, to further streamline the provisions, the most popular and readily available grade-thickness combinations are retained and the less popular and readily available grade-thickness combinations are

removed. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to Section R505.2.3. Finally, the reference to 97 mil product is deleted. It is very uncommon in residential construction, and, if need be, the user can still use AISI S230, where solutions include 97 mil product.

- **R505.2.5:** The title is fixed to match others in section and the screw substitution factor is eliminated. This is seldom used in prescriptive design and adds complexity to the provisions.
- **Figure R505.2.6.3:** Title correction.
- **Table R505.3.1(1):** The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial corrections are made to column titles.
- **R505.3.2**: The multi-span joist tables are deleted from the IRC – Tables R505.3.2(2) and R505.3.2(3). These add volume and complexity, but do not provide significant improvement over the single-span tables. Rather, the single span table, Table R505.3.2, can be used conservatively for continuous spans. If the user wants, they can go to AISI S230 for a multi-span solution. To be consistent with changes in other sections, Table R505.3.2 now applies to both Grade 33 ksi and Grade 50 ksi. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to a new table note. Please note that, while Grade 50 ksi steel is now required for 54 mil and 68 mil product, no changes are made to the allowable span spacing, thus resulting in additional conservatism. Also, the reference to 97 mil product is deleted.
- **R505.3.4:** The option for clip angle bearing stiffeners is deleted, including Tables R505.3.4(1) through R505.3.4(4) and the clip angle option shown in Figure R505.3.4(2). The option is quite limited in its application after references to the 97 mil product are removed. The user can go to AISI S230, if they want to utilize clip angle bearing stiffeners.
- **M1308.1, M2101.6, and P2603.2**: Cross-references are updated in each of these sections.

Cost Impact: The code change proposal will not increase the cost of construction.

RB258-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R505-RB-MANEY.doc

RB259 – 13
R506.2.2

Proponent: Stephen S. Szoke, P.E./Portland Cement Association/Portland Cement Association

Revise as follows:

R506.2.2 Base. A 4-in. thick (102 mm) base course consisting of clean graded sand, gravel, crushed stone, crushed concrete, or crushed blast furnace slag passing a 2-inch (51 mm) sieve shall be placed on the prepared subgrade when the slab is below grade.

> **Exception:** A base course is not required when the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

Reason: Concrete is commonly recycled by crushing the concrete for use as aggregate. The aggregate is sometimes used in new concrete, but the most use of this aggregate formed from crushed concrete is for base materials. The use of crushed concrete as base material for slab on ground construction is permitted in American Concrete Institute 332 *Residential Code Requirements for Structural Concrete* and is cited as an acceptable practice in the commentary of the ICC *International Green Construction Code* commentary. However, since crushed concrete is not specifically cited in the IRC several building code departments have resisted the use of crushed concrete as base material for slab on ground construction. This change specifically adds crushed concrete to the list of acceptable materials and helps assure that this sustainable building practice, the use of crushed concrete in lieu of virgin aggregates, is permissible in the IRC.

Cost Impact: This change will not increase the cost of construction.

RB259-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R506.2.2-RB-SZOKE.doc

RB260 – 13
R507.2.3

Proponent: Hoyt D Jeter, Eagle Eye Consulting Engineers, representing Washington Association of Building Officials Technical Code Development Committee (hoytjeter@centurytel.net)

Revise as follows:

R507.2.3 Deck lateral load connection. The lateral load connection required by Section R507.1 shall be permitted to be in accordance with Figure R507.2.3. Where the lateral load connection is provided in accordance with Figure 507.2.3, hold-down tension devices shall be installed in not less than two locations per deck, <u>within 24" of each end of the deck</u> .Each device shall have an allowable stress design capacity of not less than 1500 pounds (6672 N).

Reason: Currently the IRC does not specify where the hold-down connection devices must be placed. The purpose of this code change is to provide clear guidance as to where to locate the lateral load hold-down devices for decks. To maximize the efficiency of the hold downs they should be placed as far apart as possible near the ends of the deck. Deck joist framing typically is not spaced greater than 24" on center so 24 " was selected as the upper limit to place these hold downs.

Cost Impact: The code change proposal will not increase the cost of construction, it will decrease the cost.

RB260-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.2.3 #1-RB-JETER.doc

RB261 – 13
R507.2.3

Proponent: Hoyt D Jeter, Eagle Eye Consulting Engineers, representing Washington Association of Building Officials Technical Code Development Committee (hoytjeter@centurytel.net)

Revise as follows:

R507.2.3 Deck lateral load connection. The lateral load connection required by Section R507.1 shall be permitted to be in accordance with Figure R507.2.3. Where the lateral load connection is provided in accordance with Figure 507.2.3, hold-down tension devices shall be installed in not less than two locations per deck, and each device shall have an allowable stress design capacity of not less than 1500 pounds (6672 N).

> **Exception:** Hold-down tension devices are not required for decks no more than 30 inches above grade at any point.

Reason: The requirement to provide lateral load connections for attached decks was introduced into the code to insure that live loads (usually resulting from human activity on the deck) will not cause failure of the deck ledger connection thereby allowing the deck to pull-away from the primary structure. Taken literally, all decks, even if they are 6" above grade, must be provided with lateral load connection devices (i.e. hold-downs). The exemption to install lateral load connection devices for decks 30" or less above grade was chosen because that is the same height at which the code currently exempts guardrails. The proposed exception does not exclude the requirement to adequately connect the deck ledger to the primary structure, as required elsewhere in the code.

Cost Impact: The code change proposal will decrease the cost of construction.

RB261-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.2.3 #2-JETER.doc

RB262 – 13
R507.2.3, Figure R507.2.3(2) (NEW)

Proponent: Hoyt Jeter, Eagle Eye Consulting Engineers, representing Washington Association of Building Officials Technical Code Development Committee (hoytjeter@centurytel.net)

Revise as follows:

R507.2.3 Deck lateral load connection. The lateral load connection required by Section R507.1 shall be permitted to be in accordance with Figures R507.2.3(1) or R507.2.3(2). Where the lateral load connection is provided in accordance with Figure 507.2.3(1), hold-down tension devices shall be installed in not less than two locations per deck, and each device shall have an allowable stress design capacity of not less than 1500 pounds (6672 N). Where the lateral load connections is provided in accordance with Figure R507.2.3(2), the hold-down tension devices shall be installed in not less than 4 locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds (3336 N).

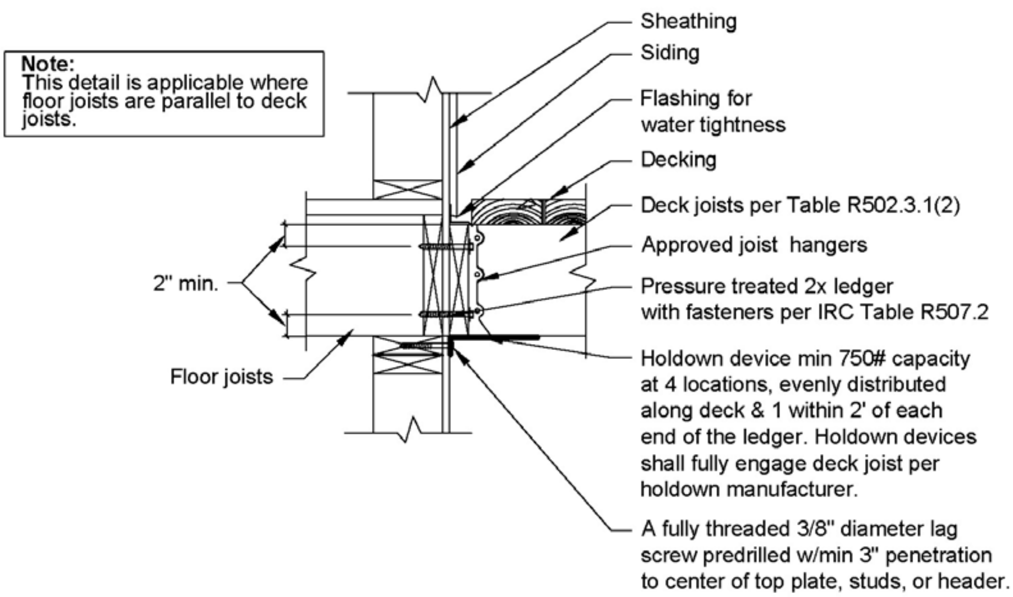


FIGURE R507.2.3(2)

Reason: This proposal provides an alternative prescriptive method to achieve an acceptable lateral load connection for residential decks. For new or replacement decks on existing homes, builders or homeowners must often remove interior sheet rock on ceilings in order to install hold-down tension devices as required by Figure 507.2.3. This proposal achieves an acceptable lateral load connection between the deck and primary structure by permitting the installation of surface mounted hold-down connection devices spread out along the length of the ledger and precludes the need to make expensive and unnecessary ceiling repairs.

Typical deck failures occur because joists separate from the joist-hangers which are fastened to the ledger. This is due to the lack of an adequate tension connection between the joist and the hanger at this joint. This proposal provides a better connection between at least 4 joists and the primary structure thereby reducing the potential failure of the joist to joist-hanger connection and better support form complete collapse of the deck and will reduce the chance of injury.

Cost Impact: The code change proposal will not increase the cost of construction, it will decrease the cost.

RB262-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.2.3 #3-JETER.doc

RB263 – 13
R507.1, R507.2.3, Figure R507.2.3

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

R507.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads.

> <u>**Exception:** Design for lateral loads, and connectors in accordance with Section R507.3, shall not be required for decks that do not require guards in accordance with Section R312.1.1, provided that the deck ledger is connected to the band joist in accordance with Section R507.2.</u>

Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck.

~~R507.2.3~~ <u>R507.3</u> Deck lateral load connection. The lateral load connection required by Section R507.1 shall be permitted to be in accordance with Figure R507.~~2.~~3. Where the lateral load connection is provided in accordance with figure 507.~~2.~~3, hold-down tension devices shall be installed in not less than two locations per deck, and each device shall have an allowable stress design capacity of not less than 1500 pounds (6672 N).

FIGURE ~~507.2.3~~ <u>507.3</u>
DECK ATTACHMENT FOR LATERAL LOADS

(Figure remains unchanged)

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The provisions for deck design and attachment to the house have evolved in recent years. The IRC is now very strong on appropriate attachment to the main structure, as it should be. However, the specific provision in R507.1 that requires design for lateral loads, and the prescriptive hold-down tension connector alternative of R507.2.3, seem overly conservative for decks that are at grade, when these decks do not even require guardrails. For at-grade decks, the lag screw/bolt connections from deck ledger to band joist required by R507.2 are adequate. Elevated decks would still be required to be designed for lateral loads in accordance with R507.1 or the prescriptive hold-down tension devices specified in R507.2.3 (figure included below for convenience).

The renumbering of current Section R507.2.3 to R507.3 is necessary because current Section R507.2.3 serves as a prescriptive alternative to the requirement for design for lateral loads in R507.1. The purpose of the exception is to retain the requirement for ledger-to-band joist lags or bolts in current R507.2, R507.2.1, and R507.2.2, but exempt low decks from the prescriptive hold-down tension devices (or design for lateral load) in current section R507.2.3. Moving current R507.2.3 to its own section allows easier reference to the lag/screw connection requirements.

Cost Impact: The code change proposal could reduce the cost of construction. It could reduce the cost of construction.

RB263-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.1-RB-BAJNAI-BCAC.doc

RB264 – 13

R507.1, R507.4 (NEW), R507.5 (NEW), Figure R507.5 (NEW), Table R507.5 (NEW), R507.5.1, R507.6, Figure R507.6 (NEW), Table R507.6 (NEW), R507.7 (NEW), R507.8 (NEW), R507.8.1 (NEW), Figure R507.8.1 (NEW), R507.8.2 (NEW), Figure R507.8.2 (NEW)

Proponent: Brian Foley, P.E. Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov), Glenn Mathewson, M.C.P., North American Deck and Railing Association, Randy Shackleford, P.E., Simpson Strong-Tie

Revise as follows:

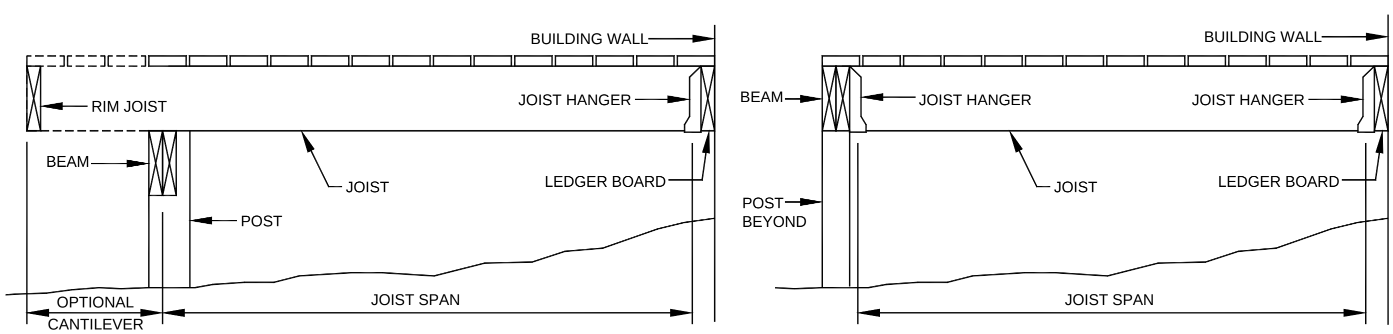
R507.1 Decks. Wood decks shall be in accordance with this section. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck. The use of other grades, species, loading, materials and conditions not described herein shall be permitted be in accordance with Section R301.

R507.4 Decking. Wood decking shall be at least a nominal 2-inch (51 mm) in thickness and placed at an angle between 45 and 90 degrees to deck joists spaced a maximum of 24-inches (610 mm) on-center. Wood decking shall be attached to each supporting member with a minimum of (2)8d threaded nails or (2)#8 wood screws.

Exceptions:

1. Wood decking with a minimum nominal thickness of 1 $^{1}/_{4}$ inches (32 mm) shall be permitted to be installed at 90 degrees to deck joists spaced a maximum of 24 inches (610 mm) on center and not less than 45 degrees to deck joists spaced a maximum of 16 inches (406 mm) on center.
2. Wood/plastic composite decking in accordance with Section R507.3.

R507.5 Allowable deck joist spans. Spans for wood deck joists, as shown in Figure R507.5, shall be in accordance with Table R507.5. Deck joist shall be permitted to cantilever a maximum of one-fourth of the joist span.



JOISTS WITH DROPPED BEAM

JOISTS WITH FLUSH BEAM

FIGURE R507.5
TYPICAL DECK JOIST SPANS

TABLE R507.5
DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft.-in.)

SPECIES[a]	SIZE	SPACING OF DECK JOISTS WITH NO CANTILEVER[b] (in.)			SPACING OF DECK JOISTS WITH CANTILEVERS[c] (in.)		
		12	16	24	12	16	24
Southern pine	2 x 6	10-4	9-5	7-10	7-1	7-1	7-1
	2 x 8	13-8	12–5	10–2	10-9	10-9	10-2
	2 x 10	17-5	15–10	13–1	15-6	15-6	13-1
	2 x 12	18-0	18–0	15-5	18-0	18-0	15-5
Douglas fir-larch[d], hem-fir[d] spruce-pine-fir[d]	2 x 6	9-6	8-8	7-2	6-3	6-3	6-3
	2 x 8	12-6	11–1	9-1	9-5	9-5	9-1
	2 x 10	15-8	13–7	11-1	13-7	13-7	11-1
	2 x 12	18-0	15–9	12-10	18-0	15-9	12-10
Redwood, western cedars, ponderosa pine[e], red pine[e]	2 x 6	8-10	8-0	7-0	5-7	5-7	5-7
	2 x 8	11-8	10–7	8-8	8-6	8-6	8-6
	2 x 10	14-11	13–0	10-7	12-3	12-3	10-7
	2 x 12	17-5	15-1	12-4	16-5	15-1	12-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. No. 2 grade with wet service factor.
b. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360.
c. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220 pound point load applied to end.
d. Includes incising factor.
e. Northern species with no incising factor

R507.5.1 Lateral restraint at supports. Joist ends and bearing locations shall be provided with lateral restraint to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with a minimum of (3)10d threaded nails or (3)#10x3 inch (76 mm) long wood screws.

R507.6 Deck Beams. Spans for deck beams, as shown in Figure R507.6, shall be in accordance with Table R507.6. Beam plies shall be fastened with two rows of 10d threaded nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the beam span. Splices of multi-span beams shall be located at interior post locations.

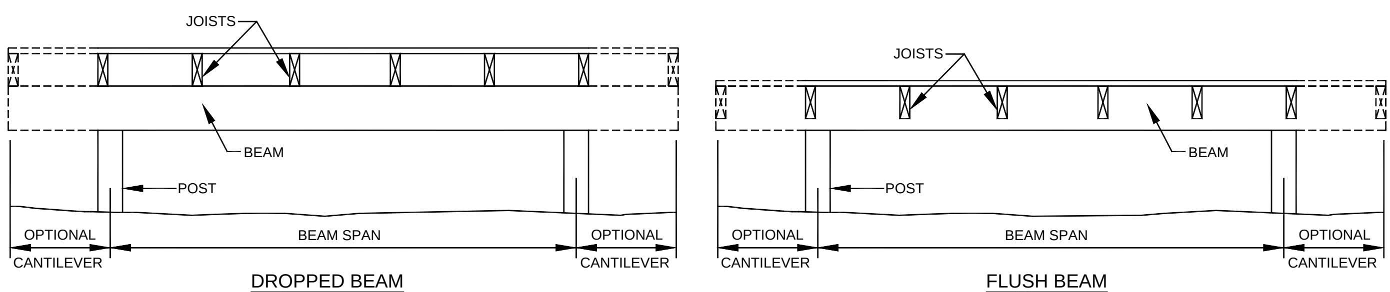


FIGURE R507.6
TYPICAL DECK BEAM SPANS

TABLE R507.6
DECK BEAM SPAN LENGTHS (ft.-in.)[a, b]

SPECIES[c]	SIZE[d]	DECK JOIST SPAN (ft.) LESS THAN OR EQUAL TO:						
		6	8	10	12	14	16	18
Southern pine	2-2x6	7-1	6-2	5-6	5-0	4-8	4-4	4-1
	2-2x8	9-2	7-11	7-1	6-6	6-0	5-7	5-3
	2-2x10	11-10	10-3	9-2	8-5	7-9	7-3	6-10
	2-2x12	13-11	12-0	10-9	9-10	9-1	8-6	8-0
	3-2x6	8-7	7-8	6-11	6-3	5-10	5-5	5-2
	3-2x8	11-4	9-11	8-11	8-1	7-6	7-0	6-7
	3-2x10	14-5	12-10	11-6	10-6	9-9	9-1	8-7
	3-2x12	17-5	15-1	13-6	12-4	11-5	10-8	10-1
Douglas fir-larch[e], hem-fir[e], spruce-pine-fir[e], redwood, western cedars, ponderosa pine[f], red pine[f]	3x6 or2-2x6	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	3x8 or 2-2x8	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	3x10 or 2-2x10	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	3x12 or 2-2x12	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	4x6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	4x8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	4x10	9-11	8-7	7-8	7-0	6-6	6-1	5-8
	4x12	11-5	9-11	8-10	8-1	7-6	7-0	6-7
	3-2x6	7-4	6-8	6-0	5-6	5-1	4-9	4-6
	3-2x8	9-8	8-6	7-7	6-11	6-5	6-0	5-8
	3-2x10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3-2x12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

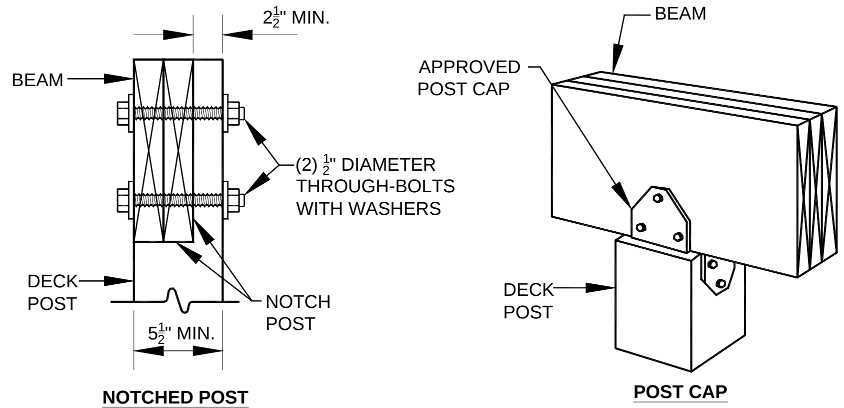
a. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220 pound point load applied at the end.
b. Beams supporting deck joists from one side only.
c. No 2 grade, wet service factor.
d. Beam depth shall be greater than or equal to depth of joists with a flush beam condition.
e. Includes incising factor.
f. Northern species with no incising factor.

R507.7 Deck joist and deck beam bearing. The ends of each joist and beam shall have not less than 1.5 inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) on concrete or masonry for the entire width of the beam. Joist framing into the side of a ledger board or beam shall be supported by approved joist hangers. Beam bearing at deck posts shall be in accordance with Section R507.8.1.

R507.8 Deck posts. For single level wood decks with beams sized in accordance with Table R507.6, posts shall be a minimum nominal 6x6 with a maximum height of 14 feet (5486 mm) measured to the underside of the beam.

Exception: Nominal 4x4 or 4x6 posts shall be permitted with a maximum height of 8 feet (2438 mm).

R507.8.1 Deck post to deck beam. Deck beams shall be attached to deck posts in accordance with Figure R507.8.1. Post to beam connections shall be constructed to resist lateral displacement. Manufactured post-to-beam connectors shall be sized for the post and beam sizes. All bolts shall have washers under the head and nut.



For SI: 1 inch = 25.4 mm

FIGURE R507.8.1
DECK BEAM TO DECK POST

R507.8.2 Deck post to deck footing. Posts shall bear on footings in accordance with Section R403 and Figure R507.8.2.

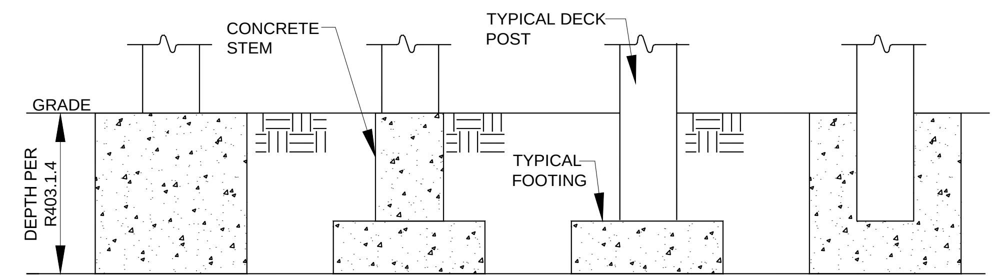


FIGURE R507.8.2
TYPICAL DECK POSTS TO DECK FOOTINGS

Reason: Wood decks are the most prolific structure to be constructed to a residential dwelling, yet there is very little guidance in the IRC regarding the structural capacity of the joists, beams and posts. The existing span tables in Chapter 5 do not address wood decks due to the differences in their design considerations. Some builders and code officials often rely on span tables developed by AHJs or the DCA6 published by the American Wood Council, while others have nothing to refer to.

With the permission of the American Wood Council, we have provided in this proposal their span tables for typical joists and beams and height requirements for typical posts based on the most common wood species and grade used throughout the country. Attachment and bearing requirements are also provided to give the user guidance on how these elements connect. With the existing provisions already in Section 507, the IRC user would be able to design and construct a safe wood deck.

Careful attention was given to ensure these new provisions did not and could not deter the construction of decks composed of other materials and in different configurations and conditions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB264-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.1-RB-FOLEY.doc

RB265 – 13
R507.2, Table 507.2, R507.2.1, R507.2.2, R507.2.3 (NEW)

Proponent: Glenn Mathewson, North American Deck and Railing Association, representing The Colorado Chapter of the International Code Council, (GlennMathewson@nadra.org)

Revise as follows:

R507.2 Deck leger connection to band joist. ~~For decks supporting a total design load of 50 pounds per square foot (2394 Pa) [40 pounds per square foot (1915 Pa) live load plus 10 pounds per square foot (479 Pa) dead load], the connection between a deck ledger of pressure-preservative-treated Southern Pine, incised pressure-preservative-treated Hem-Fir, or *approved* decay-resistant species, and a 2-inch (51mm) nominal lumber band joist bearing on a sill plate or wall plate shall be constructed with ½-inch (12.7 mm) lag screws or bolts with washers in accordance with Table R507.2. Lag screws, bolts and washers shall be hot-dipped galvanized or stainless steel.~~ Deck ledger connections to band joists shall be in accordance with this section and Table R507.2, Table R507.2.1, Figure R507.2.1(1) and Figure R507.2.1(2). For other grades, species, connection details, and loading conditions, decks shall be designed in accordance with section R301.

~~**R507.2.1 Placement of lag screws or bolts in deck ledgers and band joists.** The lag screws or bolts in deck ledgers and band joists shall be placed in accordance with Table R507.2.1 and Figures R507.2.1(1) and R507.2.1 (2).~~

R507.2.1 Ledger details. Deck ledgers installed in accordance with section R507.2 shall be a minimum 2 x 8 nominal, pressure-preservative-treated or approved, naturally durable, No. 2 grade or better lumber. Deck ledgers installed in accordance with section R507.2 shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.

~~**R507.2.2 Alternate deck ledger connections.** Deck ledger connections not conforming to Table R507.2 shall be designed in accordance with accepted engineering practice. Girders supporting deck joists shall not be supported on deck ledgers or band joists. Deck ledgers shall not be supported on stone or masonry veneer.~~

R507.2.2 Band joist details. Band joists attached by a ledger in accordance with section R507.2 shall be a minimum 2-inch-nominal, solid-sawn, spruce-pine-fir lumber or a minimum 1 x 9.5 dimensional, Douglas fir, laminated veneer lumber. Band joists attached by a ledger in accordance with section R507.2 shall be fully supported by a wall or sill plate below.

R707.2.3 Ledger to band joist fastener details. Fasteners used in deck ledger connections in accordance with Table R507.2 shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.2.1 and Figure R507.2.1(1) and Figure R507.2.1(2).

TABLE R507.2
~~**FASTENER SPACING FOR A SOUTHERN PINE OR HEM-FIR DECK LEDGER AND A 2-INCH-NOMINAL SOLID-SAWN SPRUCE-PINE-FIR BAND JOIST**~~[~~c, f, g~~]
DECK LEDGER CONNECTION TO BAND JOIST[c, d, e]
(Deck live load = 40 psf, deck dead load = 10 psf, snow load <= 40 psf)

	JOIST SPAN						
~~JOIST SPAN~~	6' and less	6'1" to 8'	8'1" to 10'	10'1" to 12'	12'1" to 14'	14'1" to 16'	16'1" to 18'
Connection details	**On-center spacing of fasteners**[~~d, e~~]						
½ inch diameter lag screw with $^{15}/_{32}$ inch maximum sheathing[a]	30	23	18	15	13	11	10

½ inch diameter bolt with $^{15}/_{32}$ inch maximum sheathing	36	36	34	29	24	21	19
½ inch diameter bolt with ~~$^{15}/_{32}$~~ 1 inch maximum sheathing ~~and ½ inch washers~~[~~b, h~~ b]	36	36	29	24	21	18	16

For SI: 1 inch =n 25.4 mm, 1 foot = 304.8 mm. 1 pound per square foot = 0.0479 kPa.

a. The tip of the lag screw shall fully extend beyond the inside face of the band joist.

~~b. The maximum gap between the face of the ledger board and face of the wall sheathing shall be ½ inch.~~

b. Up to ½-inch thickness of stacked washers shall be permitted to substitute for up to ½-inch of allowable sheathing thickness.

c. Ledgers shall be flashed in accordance with Section R703.8 to prevent water from contacting the house band joist.

~~d. Lag screws and bolts shall be staggered in accordance with Section R507.2.1~~

~~e. Deck ledger shall be minimum 2 x 8 pressure-preservative-treated No. 2 grade lumber, or other approved materials as established by standard engineering practice.~~

~~f. When solid-sawn pressure-preservative-treated deck ledgers are attached to a minimum 1-inch-thick engineered wood product (structural composite lumber, laminated veneer lumber or wood structural panel band joist), the ledger attachment shall be designed in accordance with accepted engineering practice.~~

~~g. A minimum 1 x 9 1/2 Douglas Fir laminated veneer lumber rimboard shall be permitted in lieu of the 2-inch nominal band joist~~

~~h~~ d. Wood structural panel ~~sheathing~~, gypsum board ~~sheathing~~, fiberboard, lumber, or foam sheathing ~~not exceeding 1 inch in thickness~~ shall be permitted. ~~The maximum distance between the face of the ledger board and the face of the band joist shall be 1 inch.~~

e. Snow load shall not be assumed to act concurrently with live load.

Reason: The prescriptive ledger bolting provisions are very specific, yet difficult to understand and somewhat contradictory between the language in Section R507.2 and that of Table R507.2. Overall, this code modification proposal does not intend to change the application of the current provisions.

--Footnote “h” is the only place where the description of the type of sheathing permitted is provided. However, footnote “h” is only referenced in one of the three connection methods in the table. This has been corrected to reflect that the various sheathing types are allowed under all methods by placing the footnote reference in the main title of the table.

--Fiberboard (“black celotex®” or “thermoply® for example) and lumber sheathing (diagonal wood sheathing) is likely to be encountered in deck construction on existing homes. The current provision provides a blanket approval of “foam sheathing” which includes varying compositions and performance levels without regard. Under that consideration, fiberboard and lumber should certainly be acceptable up to the same maximum thickness.

--Footnote "b" and "h" are discussing the same topic but with different points of references. This is confusing, and has been corrected.

--Why list various engineered wood products in footnote f and reference what we already know about engineered alternatives. This is unnecessary text. They are alternatives and need to be approved under R104.11 or R301.

--In the current language, the description of allowable species for ledger material is not consistent between the section language, table title and table footnotes. The Section refers to decay resistant properties of PPT pine or hem-fir, and then continues with an ambiguous reference to “approved decay-resistant species” leaving it to the building official to decide. The Table heading, however, refers only to the pine and hem-fir and not the use of decay-resistant species. It is further confused with the references in the table footnotes for use of any PPT, No 2 grade lumber species or engineering. There is no consistency and it is not user friendly. The proposed language makes use of the IRC-defined term “naturally durable lumber” as opposed to “decay-resistant” and clearly explains the materials allowed under this connection method in the body of the code as opposed to footnotes in a table.

--“Rim Board" is a registered trademark of APA. The use of the term "rimboard" in discussions unique to engineered wood products used as band joists infers that said engineered band joist must be one rated by APA. The IRC does not require engineered lumber band joists to be APA rated "Rim Board”. It is simply too similar to a proprietary trademark to be appropriate terminology for the IRC, when the industry- and IRC-wide term “band joist” is available for use.

--The description of the allowable materials for the home’s band joist are described in the Section, the Table title and then again in the footnotes. As with the ledger material, this is now described only in the body of the code section.

--The current language would prohibit the connection of a deck ledger to a band joist that was larger in it's narrow cross-section than 2-inches, thus the term "minimum" has been moved in front of this size description.

Prohibition to supporting beams/girders on ledgers and band joist after the sentence about “engineering practice” and under the heading of “alternate deck ledger connections” is misleading. A design professional should not be prohibited from making such design. The intent has been presented more clearly in this proposal, that simply the fastening schedule does not anticipate concentrated loads from beams.

Cost Impact: This code change proposal will not increase the cost of construction.

RB265-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507.2-RB-MATHEWSON.doc

RB266 – 13

R202, Table R301.5, R311.7.5.4, R311.7.8.1, R377.7.8.4, R312.1.4, R317.4, R317.4.1, R317.4.2, R318.1, R507.3, R507.3.1, R507.3.2 (NEW), R507.3.3 (NEW), R507.3.4 (NEW), R507.3.5 (NEW), R507.3.6 (NEW), Index

Proponent: Marcelo M Hirschler, GBH International (gbhint@aol.com)

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

USE	LIVE LOAD
~~Guardrails~~ Guards and handrails[d]	200[h]
~~Guardrail~~ Guard in-fill components[f]	50[h]

R311.7.5.4 Exterior ~~wood/~~plastic composite stair treads. ~~Wood/plastic~~ Plastic composite stair treads shall comply with the provisions of Section R507.3.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. When handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to ~~guardrail~~ guard, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

R311.7.8.4 Exterior ~~wood/plastic~~ plastic composite handrails. ~~Wood/plastic~~ Plastic composite exterior handrails shall comply with the ~~provisions~~ requirements of Section R507.3.

R312.1.4 Exterior ~~wood/plastic~~ plastic composite guards. ~~Wood/plastic~~ Plastic composite exterior guards shall comply with the ~~provisions~~ requirements of Section ~~R317.4~~ R507.3.

~~**R317.4 Wood/plastic composites.** Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a *label* indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.~~

R317.4 Plastic composites. Plastic composite exterior deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall comply with the provisions of Section R507.3.

~~**R317.4.1 Labeling.** Deck boards and stair treads shall bear a label that indicates compliance to ASTM D 7032 and includes the allowable load and maximum allowable span. Handrails and guardrail systems or their packaging shall bear a label that indicates compliance to ASTM D7032 and includes the maximum allowable span.~~

~~**R317.4.2 Installation.** Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.~~

R318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table R301.2(1), methods of protection shall be one of the following methods or a combination of these methods:

1. Chemical termiticide treatment, as provided in Section R318.2.
2. Termite baiting system installed and maintained according to the *label*.
3. Pressure-preservative-treated wood in accordance with the provisions of Section R317.1.
4. Naturally durable termite-resistant wood.
5. Physical barriers as provided in Section R318.3 and used in locations as specified in Section R317.1.
6. Cold-formed steel framing in accordance with Sections R505.2.1 and R603.2.1.
7. Plastic composite exterior deck boards, stair treads, guards and handrails in accordance with the provisions of Section R507.3.

Revise as follows:

R507

EXTERIOR DECKS

~~**R507.3 Wood/plastic composites.** Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a label indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.~~

R507.3 Plastic composite deck boards, stair treads, guards and handrails. Plastic composite deck boards, stair treads, guards and hand rails shall comply with Section R507.3.1 through R507.3.6.

~~**R507.3.1 Installation of wood/plastic composites.** Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.~~

R507.3.1 General. Plastic composites shall consist either of wood/plastic composites or of plastic lumber. Plastic composite exterior deck boards, stair treads, guards and handrails shall comply with the requirements of ASTM D7032 and with the additional requirements of Section R507.3.

R507.3.2 Labeling. Plastic composite deck boards and stair treads, or their packaging, shall bear a *label* that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span, determined in accordance with ASTM D7032. Plastic composite handrails and guards, or their packaging, shall bear a *label* that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span, determined in accordance with ASTM D7032.

R507.3.3 Flame Spread Index. Plastic composite deck boards, stair treads, guards and handrails shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.

Exception: Plastic composites determined to be noncombustible.

R507.3.4 Decay resistance. Plastic composite deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall be termite and decay resistant in accordance with ASTM D7032.

R507.3.5 Termite resistance. Where required by Section 318, plastic composite deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall be termite resistant in accordance with ASTM D7032.

R507.3.6 Installation of plastic composites. Plastic composite deck boards, stair treads, guards and handrails shall be installed in accordance with this code and the manufacturers' instructions.

Revise as follows:

PLASTIC COMPOSITE. A generic designation that refers to wood/plastic composites and plastic lumber.

~~**WOOD/PLASTIC COMPOSITE.** A composite material made primarily from wood or cellulose-based materials and plastic.~~

Revise Index as follows:

Reason: This proposal recommends permitting the use of plastic composites for exterior applications as deck boards, stair treads, handrails and guards. The term "plastic composites" is a designation that was accepted by the IBC to incorporate wood/plastic composites and plastic lumber.

Both plastic composites and plastic lumber are products are made of plastic materials with added fibrous materials to provide stiffness. There are some differences between the two, but they are relatively subtle. Wood plastic composites contain wood materials, or cellulosic materials, (normally over 50%) as the primary fiber that provides the stiffness. On the other hand plastic lumber materials contain primarily plastic (normally over 50%) and use a variety of materials to provide stiffness, often fiberglass. Acceptance Criteria AC 174, Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails) is used for both types of materials and it requires compliance with requirements in specification ASTM D7032, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails), presently referenced in the IBC, the IRC and in the IWUIC.

Numerous plastic lumber decks are used throughout the US, but the IRC does not reference them. The IBC 2015 will reference plastic composite deck boards, stair treads, handrails and guards and the requirements are similar to those proposed here and the language is also consistent.

Flame spread index: wood materials normally comply with a flame spread index of no more than 200. ASTM D7032 also requires materials to comply with a flame spread index of no more than 200 when tested to ASTM E84. However, it does not have the additional requirements that the material stay in place, which is important for plastic materials and was adopted by the IBC.
The reasons for the specific requirements in the proposal are as follows:

1. The language is changed from wood/plastic composites to plastic composites.
2. All of the requirements are incorporated into section R507 (on decks) and specifically into section R507.3.
3. The requirements are technically identical to those in the IBC.
4. A definition for plastic composite is added to section 202 and the definition of wood/plastic composite, which is now no longer necessary and would cause confusion, is deleted from Section 202.
5. The information on labeling is redundant in R317 and it is being deleted as it is included in R507.3 and R317.4 sends the user to R507.3 for requirements.
6. A new subsection for plastic composites is being added to R318.1 to deal with termites.
7. The designation "guardrail" is being replaced by "guard" throughout.

For information purposes, the new section on plastic composites in the IBC reads as follows:

IBC SECTION 2612 - PLASTIC COMPOSITES

2612.1 General. *Plastic composites shall consist either of wood/plastic composites or of plastic lumber. Plastic composites shall comply with the provisions of this code and with the additional requirements of Section 2612.*

2612.2 Labeling and identification. *Packages and containers of plastic composites used in exterior applications shall bear a label showing the manufacturer's name, product identification and information sufficient to determine that the end use will comply with the code requirements.*

2612.2.1 *The label for plastic composites used in exterior applications as deck boards, stair treads, handrails and guardrail systems shall indicate the required performance levels and demonstrate compliance with the provisions of ASTM D7032.*

2612.2.2 Loading. *The label for plastic composites used in exterior applications as deck boards, stair treads, handrails and guardrail systems shall indicate the type and magnitude of the load determined in accordance with ASTM D7032.*

2612.3 Flame Spread Index. *Plastic composites shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.*

Exception: *materials determined to be noncombustible in accordance with Section 703.5.*

2612.4 Termite and Decay resistance*. Plastic composites containing wood, cellulosic or other biodegradable materials shall be termite and decay resistant as determined in accordance with ASTM D7032.*

2612.5 Construction requirements. *Plastic composites shall be permitted to be used as exterior deck boards, stair treads, handrails and guardrail systems in buildings of Class VB construction~~.~~*

2612.5.1 Span rating. *Plastic composites used as exterior deck boards shall have a span rating determined in accordance with ASTM D7032.*

2612.5.3 Handrails and Guards*. Plastic composite handrail systems shall comply with Section 1012. Plastic composite guardrail* *systems shall comply with Section 1013.*

2612.6 Plastic composite decking, handrails, and guards. *Plastic composite decking, handrails, and guardrail systems shall be installed in accordance with this code and the manufacturers' instructions.*

Cost Impact: This code change proposal will not increase the cost of construction.

RB266-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB267 – 13

R202, Table R301.5, R311.7.5.4, R311.7.8.1, R311.7.8.4, R312.1.4, R317.4, R317.4.1, R317.4.2, R318.1, R507, R507.3, R507.3.1, R507.3.2 (NEW), R507.3.3 (NEW), R507.3.4 (NEW), R507.3.5 (NEW), INDEX B

Proponent: John Woestman, Kellen Company, representing Composite Lumber Manufacturers Association (CLMA) (jwoestman@kellencompany.com)

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

USE	LIVE LOAD
Uninhabitable attics without storage[b]	10
Uninhabitable attics with limited storage[b, g]	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks[e]	40
Fire escapes	40
~~Guardrails~~ Guards and handrails[d]	200[h]
~~Guardrail~~ Guard in-fill components[f]	50[h]
Passenger vehicle garages[a]	50[a]
Rooms other than sleeping room	40
Sleeping rooms	30
Stairs	40[c]

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2,
1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
b. Uninhabitable attics without storage are those where the maximum clear height between joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches high by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
d. A single concentrated load applied in any direction at any point along the top.
e. See Section R502.2.2 for decks attached to exterior walls.
f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
g. Uninhabitable attics with limited storage are those where the maximum clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.
The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:
1. The attic area is accessible from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is a minimum of 30 inches.

2. The slopes of the joists or truss bottom chords are no greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 lb/ft^2.

h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

Revise definitions as follows:

PLASTIC COMPOSITE. A generic designation that refers to wood/plastic composites and plastic lumber.

~~**WOOD/PLASTIC COMPOSITE.** A composite material made primarily from wood or cellulose-based materials and plastic.~~

Revise as follows:

R311.7.5.4 Exterior ~~wood/~~plastic composite stair treads. ~~Wood/plastic~~ Plastic composite exterior stair treads shall comply with the ~~provisions~~ requirements of this section and Section R507.3.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. When handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to ~~guardrail~~ guard, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

R311.7.8.4 Exterior ~~wood/~~plastic composite handrails. ~~Wood/plastic~~ Plastic composite exterior handrails shall comply with the ~~provisions~~ requirements of Section R507.3.

R312.1.4 Exterior ~~wood~~plastic composite guards. ~~Woodplastic~~ Plastic composite exterior *guards* shall comply with the ~~provisions~~ requirements of ~~Section R317.4~~ Section R507.3.

~~**R317.4 Wood/plastic composites.** Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a *label* indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.~~

~~**R317.4.1 Labeling.** Deck boards and stair treads shall bear a label that indicates compliance to ASTM D 7032 and includes the allowable load and maximum allowable span. Handrails and guardrail systems or their packaging shall bear a label that indicates compliance to ASTM D 7032 and includes the maximum allowable span.~~

~~**R317.4.2 Installation.** Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.~~

R317.4 Plastic composites. Plastic composite exterior deck boards, stair treads, guards, and handrails containing wood, cellulosic or other biodegradable materials shall comply with the requirements of Section R507.3.

R318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table R301.2(1), methods of protection shall be one of the following methods or a combination of these methods:

1. Chemical termiticide treatment, as provided in Section R318.2.

2. Termite baiting system installed and maintained according to the *label*.
3. Pressure-preservative-treated wood in accordance with the provisions of Section R317.1.
4. Naturally durable termite-resistant wood.
5. Physical barriers as provided in Section R318.3 and used in locations as specified in Section R317.1.
6. Cold-formed steel framing in accordance with Sections R505.2.1 and R603.2.1.
7. Plastic composite exterior deck boards, stair treads, guards, and handrails in accordance with the provisions of Section 507.3.4.

Revise as follows:

SECTION R507
EXTERIOR DECKS

~~**R507.3 Wood/plastic composites.** Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a label indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.~~

~~**R507.3.1 Installation of wood/plastic composites.** Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.~~

R507.3 Plastic composite deck boards, stair treads, guards, or handrails. Plastic composite exterior deck boards, stair treads, guards, and handrails shall comply with the requirements of ASTM D7032 and the requirements of Section 507.3.

R507.3.1 Labeling. Plastic composite deck boards and stair treads, or their packaging, shall bear a label that indicates compliance to ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic or composite handrails and guards, or their packaging, shall bear a label that indicates compliance to ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032.

R507.3.2 Flame Spread Index. Plastic composites deck boards, stair treads, guards, and handrails shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.

> **Exception:** Plastic composites determined to be noncombustible.

R507.3.3 Decay resistance. Plastic composite deck boards, stair treads, guards, and handrails, containing wood, cellulosic, or other biodegradable materials shall be decay resistant in accordance with ASTM D7032.

R507.3.4 Termite resistance. Where required by Section 318, plastic composite deck boards, stair treads, guards, and handrails containing wood, cellulosic, or other biodegradable materials shall be termite resistant in accordance with ASTM D7032.

507.3.5 Installation of plastic composites. Plastic composite deck boards, stair treads, guards, and handrails shall be installed in accordance with this code and the manufacturer's instructions.

Revise as follows:

INDEX

B

Building Planning

~~Guardrails~~Guards. . . . . R312 (update index editorially)

Reason: This code proposal focuses on plastic composite (i.e. wood /plastic composite or plastic lumber) exterior deck boards, stair treads, guards, and handrails. This proposal:

1. In Section R507.3, incorporates the technical revisions approved for the 2015 IBC for plastic composite exterior deck boards, stair treads, guards, and handrails with text revised to be more clear and concise.
2. Revises the name of the Section 507 to Exterior Decks to help make it clear these requirements apply to exterior construction.
3. Updates / revises pointers in the IRC that point to Section R507.3.
4. Adds a pointer for termite resistance in Section R318.1.
5. Revises all guardrail / guardrails references to guard / guards for consistency of the IRC, and consistency to the IBC.
6. Proposes a definition for "plastic composites" which includes wood / plastic composites and plastic lumber. Deletes the definition of wood / plastic composites as the term is self-explanatory, especially in the context of exterior deck boards, stair treads, guards, and handrails.
7. In R317, refers to requirements in R507.3 and deletes un-needed text.
8. Editorially replaces the word "provisions" with "requirements" as "requirements" seems to convey stronger mandatory actions than "provisions".

ASTM D7032 is currently referenced in R507.3, and this proposal expands specific references to D7032, and expands the scope of materials required to comply with D7032. In addition to requirements in the IRC applicable to deck boards, stair treads, guards, and handrails, D7032 has become the standard to which these plastic lumber and wood /plastic composite exterior deck boards, stair treads, guards, and handrails are tested to evaluate and verify compliance to code requirements.

ASTM D7032 includes deck-related performance evaluations and performance requirements such as flexural tests, bio-degradation tests, fire performance tests, creep recovery tests, mechanical fastener holding tests, and slip resistance tests. The standard also includes consideration of the effects of temperature, moisture, concentrated loads, freeze-thaw resistance tests, UV resistance, and duration of load on deck boards, stair treads, guards, and handrails.

There should be no cost increase to construction as these products comply with these requirements through ICC ES AC174. There may be a slight reduction in the cost of construction as these changes to the IRC are expected to help clarify code requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

RB267-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB268 – 13
R507 (NEW)

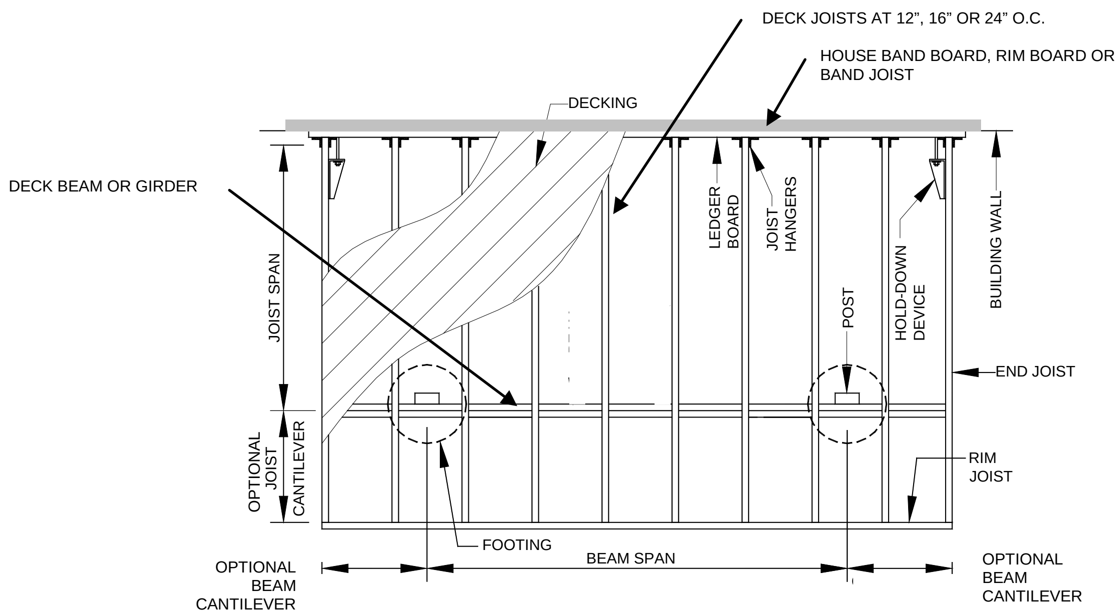
Proponent: Charles S. Bajnai, Chesterfield County, VA, representing self (bajnaic@chesterfield.gov), Randy Shackelford, Simpson Strong Tie (rshackelford@strongtie.com)

Add new text as follows:

SECTION R507
DECKS

R507.1 Wood decks. Typical wood decks shall be designed and constructed in accordance with this section. Other grades, species, loading, materials and conditions not described herein shall be permitted in accordance with Section 301. Loading for large concentrated loads, such as hot tubs, is beyond the scope of this section.

R507.2 Requirements. Deck construction shall be capable of accommodating applied loads and transmitting them to the supporting structural elements. Figure R507.2 is intended for purposes of identifying typical parts, and not to limit the design.



For SI: 1 inch = 25.4 mm

FIGURE R507.2
DECK CONSTRUCTION

R507.3 Materials. Materials used in the construction of a deck shall comply with the provisions of this section.

R507.3.1 Preservative-treated lumber. All lumber for decks shall be either naturally durable, minimum No.2 grade dimension lumber and identified in accordance with Section R502.1 or, preservative-treated in accordance with Section R317. All lumber in contact with the ground shall be identified as suitable for ground contact.

R507.3.2 Wood Decking. Wood decking shall comply with any of the following materials:

1. Wood decking with a minimum nominal thickness of $1\ ^1/_4$ inches (32 mm) shall be installed at 90 degrees to deck joists that are spaced at a maximum of 16 inches (406 mm) on center and up to 45 degrees when spaced at a maximum of 12 inches (305 mm) on center.
2. Wood decking with a nominal 2 inch (51 mm) thickness shall be installed at an angle between 45 and 90 degrees to deck joists that are spaced at a maximum of 24 inches (610 mm) on center.
3. Wood decking shall be attached to each supporting member with a minimum of (2)8d threaded nails or (2)#8 wood screws.

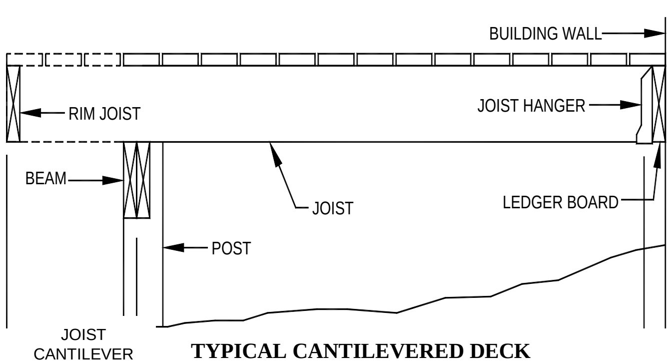
R507.3.3 Wood/plastic composites. Wood/plastic composites used as exterior deck boards, stair treads, handrails and guardrail systems shall be permitted in accordance with manufacturer's instructions.

R507.3.4 Metal guardrail systems. Metal guardrail and handrail systems shall be permitted in accordance with the manufacturer's instructions.

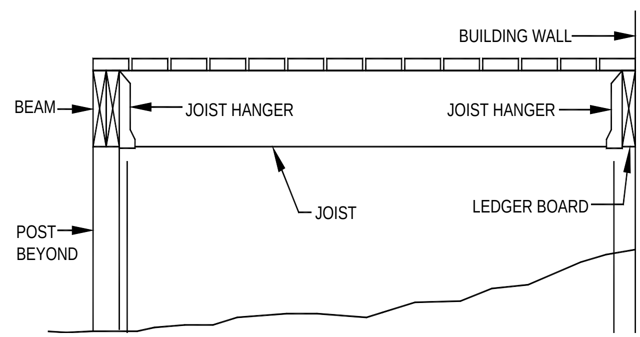
R507.3.5 Fasteners and connectors. Nails, bolts with nuts and washers, screws and connectors shall be coated in accordance with Section R317.3. Proprietary fasteners shall be permitted provided they are compatible with the pressure-preservative-treated lumber being used. Fasteners and connectors within 300 feet of salt water shoreline shall be stainless steel.

R507.3.6 Flashing. Flashing shall be corrosion-resistant metal of minimum nominal 0.019 inch (0.5 mm) thickness or approved non-metallic material.

R507.4 Deck joists. Spans for typical wood deck joist configurations, as shown in Figure R507.4, shall be in accordance with Table R507.4. Deck joists shall be permitted to cantilever a maximum of one-fourth of the joist span.

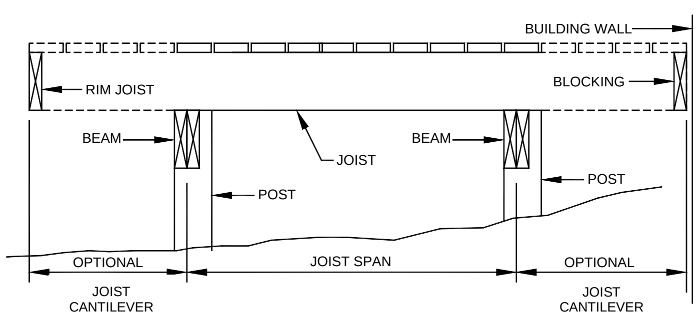


TYPICAL CANTILEVERED DECK



TYPICAL FLUSH DECK

FIGURE R507.4



TYPICAL FREE STANDING DECK

TABLE R507.4
MAXIMUM DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft.-in.)

SPECIES [a]	SIZE	MAXIMUM SPACING OF DECK JOISTS WITH NO CANTILEVER [b] (in.)			MAXIMUM SPACING OF DECK JOISTS WITH CANTILEVERS [c] (in.)		
		12	16	24	12	16	24
Southern pine	2 x 6	10-4	9-5	7-10	7-1	7-1	7-1
	2 x 8	13-8	12–5	10–2	10-9	10-9	10-2
	2 x 10	17-5	15–10	13–1	15-6	15-6	13-1
	2 x 12	18-0	18–0	15-5	18-0	18-0	15-5
Douglas fir-larch[d], hem-fir[d] spruce-pine-fir[d]	2 x 6	9-6	8-8	7-2	6-3	6-3	6-3
	2 x 8	12-6	11–1	9-1	9-5	9-5	9-1
	2 x 10	15-8	13–7	11-1	13-7	13-7	11-1
	2 x 12	18-0	15–9	12-10	18-0	15-9	12-10
Redwood, western cedars, ponderosa pine[e], red pine[e]	2 x 6	8-10	8-0	7-0	5-7	5-7	5-7
	2 x 8	11-8	10–7	8-8	8-6	8-6	8-6
	2 x 10	14-11	13–0	10-7	12-3	12-3	10-7
	2 x 12	17-5	15-1	12-4	16-5	15-1	12-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. No. 2 grade with wet service factor.
b. Deck joists shall be designed to carry the deck live load in Table R301.5 or the ground snow load, which ever is greater. This table is based on ground snow load or live load = 40 psf, dead load = 10 psf, L/Δ = 360.
c. Deck joists shall be designed to carry the deck live load in Table R301.5 or the ground snow load, which ever is greater. This table is based on ground snow load or live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220 pound point load applied to end.
d. Includes incising factor.
e. Northern species with no incising factor

R507.4.1 Joist bearing. Joist ends shall be provided with vertical and rotational support. The ends of joists shall have a minimum of 1.5 inches (38 mm) of bearing on a wood ledger board or on metal hangers. Where rotational support is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where rotational support is provided by rim joists, they shall be secured to the end of each joist with a minimum of (3)10d threaded nails or (3)#10x3 inch (76 mm) long wood screws. For free-standing decks, rotational support of the joist ends adjacent to the building wall shall be permitted by a rim joist or full depth nominal 2x blocking toe nailed at each end with (3)10d nails.

R507.5 Deck Beams. The maximum span for deck beams, as shown in Figure R507.2, shall be in accordance Table R507.5. Beams shall be permitted to cantilever at each end up to one-fourth of the beam span. The plies of a multi-ply beam shall be fastened with a minimum of two rows of 10d threaded nails at 16 inches (406 mm) on center along each edge. Splices of multi-span beams shall be located at interior post locations.

TABLE R507.5
MAXIMUM BEAM SPAN LENGTHS [a]

SPECIES	SIZE [b]	MAIN JOIST SPAN (ft.) LESS THAN OR EQUAL TO:						
		6	8	10	12	14	16	18
Southern pine	2-2x6	7-1	6-2	5-6	5-0	4-8	4-4	4-1
	2-2x8	9-2	7-11	7-1	6-6	6-0	5-7	5-3
	2-2x10	11-10	10-3	9-2	8-5	7-9	7-3	6-10
	2-2x12	13-11	12-0	10-9	9-10	9-1	8-6	8-0
	3-2x6	8-7	7-8	6-11	6-3	5-10	5-5	5-2
	3-2x8	11-4	9-11	8-11	8-1	7-6	7-0	6-7
	3-2x10	14-5	12-10	11-6	10-6	9-9	9-1	8-7

	3-2x12	17-5	15-1	13-6	12-4	11-5	10-8	10-1
Douglas fir-larch [c], spruce-pine-fir, redwood [c], western cedars, ponderosa pine [d], red pine [d]	3x6 or2-2x6	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	3x8 or 2-2x8	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	3x10 or 2-2x10	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	3x12 or 2-2x12	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	4x6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	4x8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	4x10	9-11	8-7	7-8	7-0	6-6	6-1	5-8
	4x12	11-5	9-11	8-10	8-1	7-6	7-0	6-7
	3-2x6	7-4	6-8	6-0	5-6	5-1	4-9	4-6
	3-2x8	9-8	8-6	7-7	6-11	6-5	6-0	5-8
	3-2x10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3-2x12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Deck beams shall be designed to carry the deck live load in Table R301.5 or the ground snow load, which ever is greater. This table is based on ground snow load or live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220 pound point load applied to end .No 2 grade, wet service factor.

b. Beam depth shall be greater than or equal to depth of joists with a flush beam condition.

c. Includes incising factor.

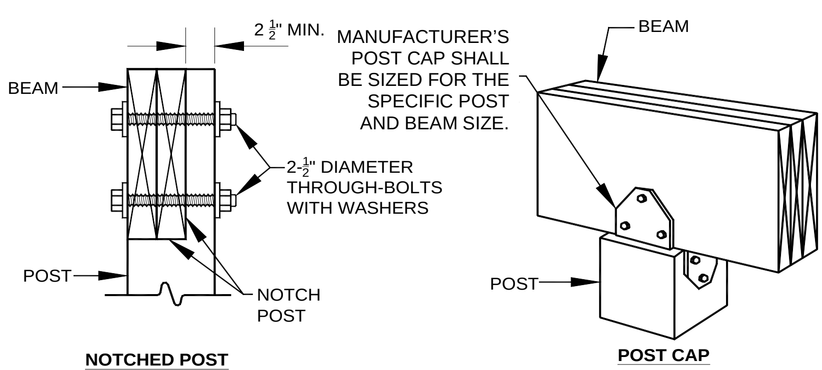
d. Northern species with no incising factor.

R507.5.1 Beam bearing. Single-ply beams and multi-ply beams shall have all of their bearing directly on wood posts or on an approved metal post cap in accordance with Figure R507.6.1 and not less than 3 inches (76 mm) on concrete or masonry.

R507.6 Deck posts. For typical single level wood decks, posts shall be measured from the top of the footing to the underside of the beam. The maximum height of the post shall be in accordance with the following:

1. Posts comprised of a minimum nominal 4x4 shall be permitted to a maximum height of 8 feet (2438 mm),
2. Posts comprised of a minimum nominal 6x6 shall be permitted to a maximum height of 14 feet (5486 mm).
3. Posts comprised of southern pine, of 4x4 or 4x6, grade #2 shall be permitted to a maximum height of 10 feet (3048 mm).
4. Posts comprised of southern pine, of 6x6 shall be permitted to a maximum height of 18 feet (5486 mm).

R507.6.1 Deck post to deck beam connection. Deck beams shall be attached to deck posts in accordance with Figure R507.6.1. Post to beam connections shall be constructed to resist lateral displacement. Manufactured post-to-beam connectors shall be sized for the post and beam sizes. All bolts shall have washers under the head and nut.



For SI: 1 inch = 25.4 mm

FIGURE R507.6.1
TYPICAL BEAM BEARING

R507.7 Deck footings. Deck footings shall be constructed in accordance with Section R403 and Figure R507.7. The size of the footing shall be adequate for the load applied by the posts.

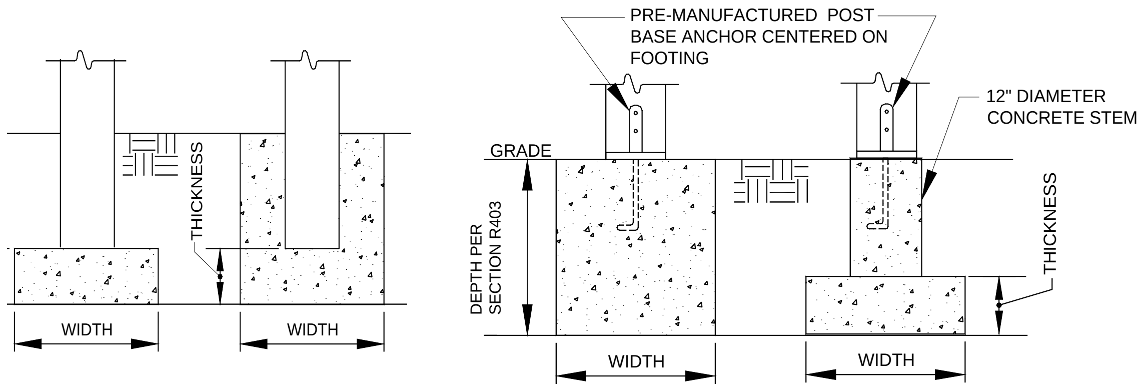


FIGURE R507.7
TYPICAL DECK FOOTINGS

R507.7.1 Footing depth. The minimum depth of footings shall be in accordance with Section R403.1.4 or as approved by the building official. A deck footing within 4 feet of the house shall be sit at least to the depth of the house footing.

R507.7.2 Post connection to footing. Where the top of the footings are at or above grade, the posts shall be prevented from being displaced by a connector between the post and the concrete. Where the top of the footings are below grade the post shall be permitted to sit on top of the footing or may be embedded in the concrete.

R507.8 Deck ledger connection to the building.. The connection between a deck ledger and the building shall be in accordance with this section.

R507.8.1 Deck ledger connection to band joist. The deck ledger shall be connected to a 2-inch nominal lumber band joist with ½-inch lag screws or bolts with washers in accordance with Table R507.8.1 and Figure R507.8.1(1). The bolts or lag screws shall be spaced in accordance with Figure R507.8.1(2). As an alternative to the detail in Figure R507.8.1, the ledger boards shall be permitted to be offset from the band joist a maximum distance of ½ inch (13 mm) with the installation of stacked washers. The exterior wall finish shall be removed prior to installation of the ledger board. Flashing at a door threshold shall be installed to prevent water intrusion from rain or melting ice and snow.

R507.8.2 Deck ledger connection to concrete foundation walls. A ledger board shall be connected to a concrete or solid masonry foundation wall with approved ½ inch (13 mm) diameter expansion anchors at a spacing specified in Table R507.8.1(1) and as shown in Figure R507.8.2. Expansion anchors shall be installed per the manufacturer.

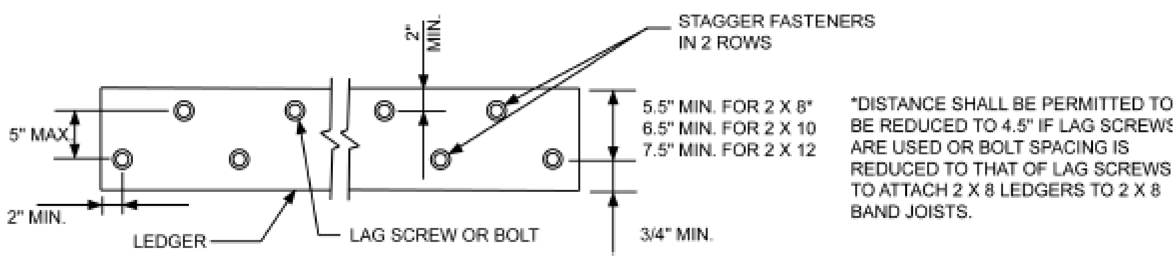
R507.8.3 Ledger board to hollow masonry foundation wall. A ledger board shall be connected to a hollow masonry foundation wall with approved ½ inch (13 mm) diameter epoxy anchors at a spacing specified in Table R507.8.1(1) and as shown in Figure R507.8.3. Epoxy anchors shall be installed per the manufacturer.

R507.8.4 Alternate connections. An approved engineered wood rim board with a minimum thickness of 1 inch (25 mm) shall be permitted to substitute for a 2x lumber band joist provided it was designed and manufactured to support a deck. A ledger board attachment to a masonry or stone veneer, ribbon board of open web floor trusses, band joist of a cantilevered floor and other conditions not addressed herein shall be designed in accordance with accepted engineering practice, or the deck shall be free-standing in accordance with Section R507.10.

TABLE R507.8.1(1)
FASTENER SPACING

FASTENER	BAND BOARD	JOIST SPAN						
		≤6'	> 6'-8'	> 8'-10'	> 10'-12'	> 12'-14'	> 14'-16'	> 16'-18'
½" lag screws [a]	1" min. engineered wood product	24"	18"	14"	12"	10"	9"	8"
	2x lumber	30"	23"	18"	15"	13"	11"	10"
½" through bolts	1" min. engineered wood product	24"	18"	14"	12"	10"	9"	8"
	2x lumber	36"	36"	34"	29"	24"	21"	19"
½" through bolts and ½" stacked washers [b]	1" min. engineered wood product	24"	18"	14"	12"	10"	9"	8"
	2x lumber	36"	36"	29"	24"	21"	18"	16"
Expansion anchors	-	36"	36"	34"	29"	24"	21"	19"
Epoxy anchors	-	32"	32"	32"	24"	24"	16"	16"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm
a. The tip of the lag screw shall fully extend beyond the inside face of the band board.
b. The maximum gap between the face of the ledger board and face of the wall sheathing shall be ½ inches (13 mm).



For SI: 1 inch = 25.4 mm.

FIGURE R507.8.1(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS

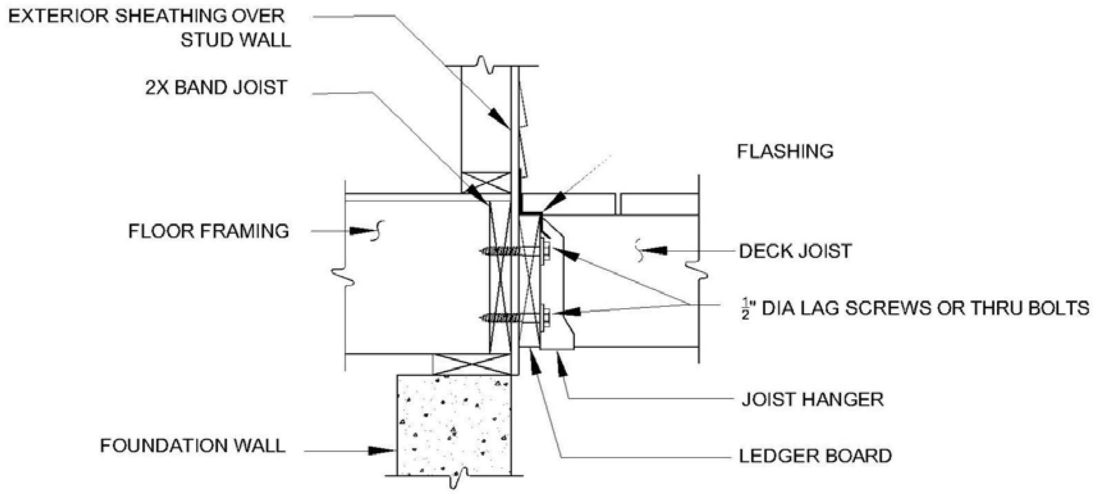


FIGURE R507.8.1(2)
LEDGER BOARD TO BAND BOARD ATTACHMENT

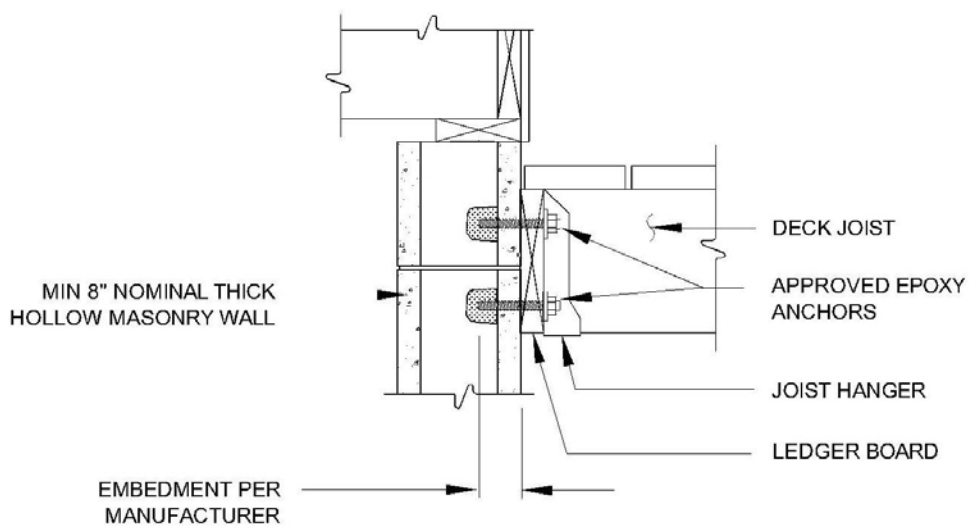


FIGURE R507.8.2
LEDGER BOARD TO SOLID FOUNDATION WALL ATTACHMENT

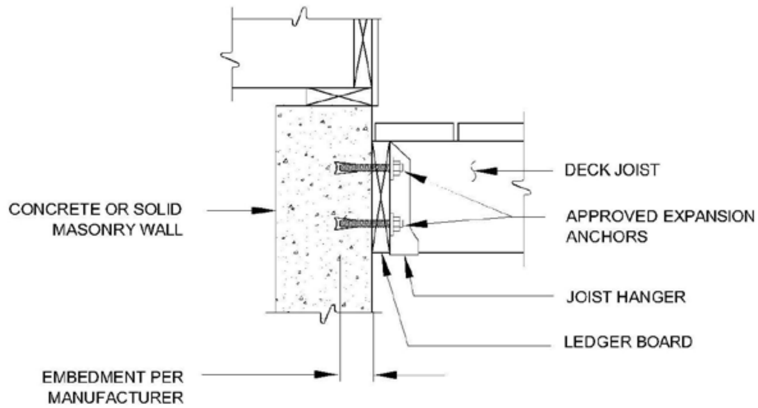
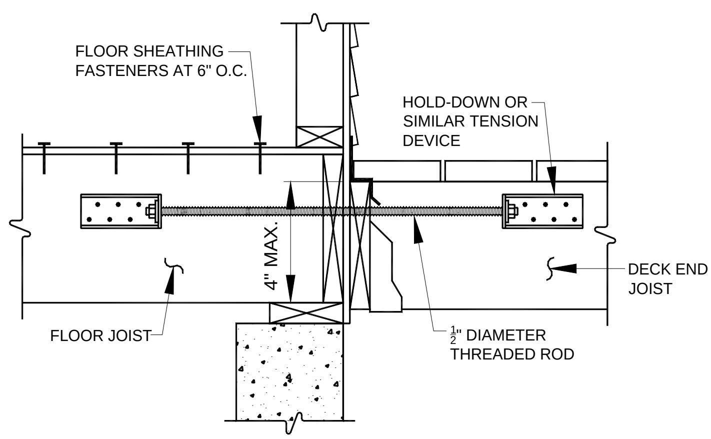


FIGURE R507.8.3
LEDGER BOARD TO HOLLOW MASONR FOUNDATION WALL ATTACHMENT

R507.9.3 Attachment to resist lateral load. A lateral load connection is required by Section R507.2. The following options shall be deemed to comply; other design solutions are permitted in accordance with R301.

R507.9.3.1 Connection at parallel joists. Where floor joists and deck joists are parallel, a hold-down or similar tension device with a minimum capacity of 1,500 pounds (6672 N) at each end joist as shown in Figures R507.3.1(1) and R507.9.3.1(2) shall be permitted. Floor sheathing to floor joists fasteners shall be permitted to be substituted with two reinforcing angles on each side of the joist with a minimum capacity of 375 pounds (1668 N).



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

FIGURE R507.9.3.1(1)
CONNECTION AT PARALLEL JOISTS

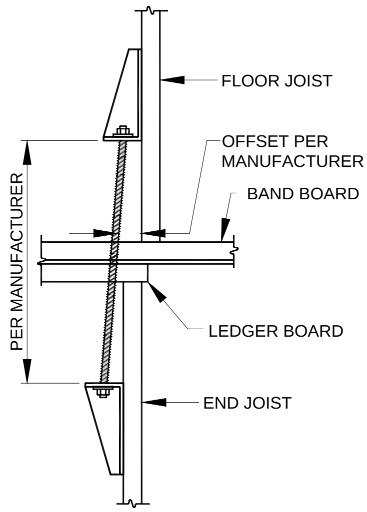
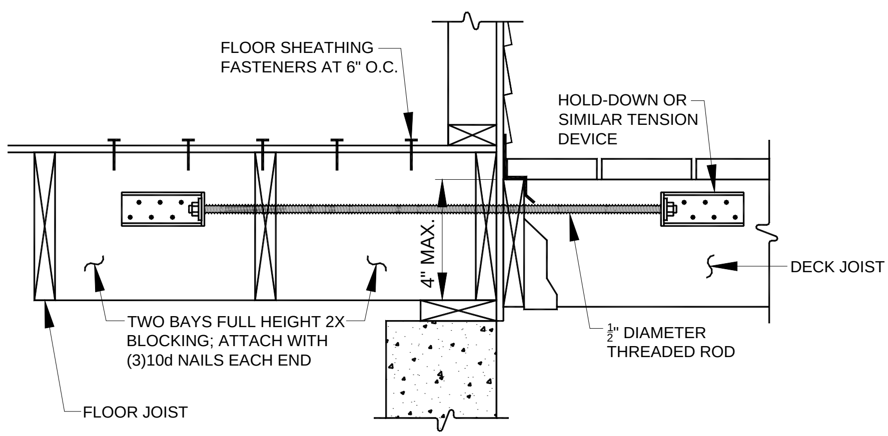


FIGURE R507.9.3.1(2)
OFFSET AT PARALLEL JOISTS

R507.9.3.2 Connection at perpendicular joists. Where floor joists and deck joists are perpendicular, provide a hold-down or similar tension device with a minimum capacity of 1,500 pounds (6672 N) at each end joist and blocking between floor joists as shown in Figure R507.9.3.2. Floor sheathing to floor joists fasteners shall be permitted to be substituted with two reinforcing angles on each side of the joist with a minimum capacity of 375 pounds (1668 N).



For SI: 1 inch = 25.4 mm

FIGURE R507.9.3.2
LATERAL SUPPORT WHERE INTERIOR JOIST PERPENDICULAR TO DECK

R507.10 Free-standing decks. As shown in Figure R507.10, free-standing decks shall have an additional beam and posts adjacent the building exterior wall in place of a ledger board attachment. The beam shall be sized in accordance with Section R507.6 and shall be located adjacent the exterior wall or at a maximum distance equal to the allowable joist cantilever.

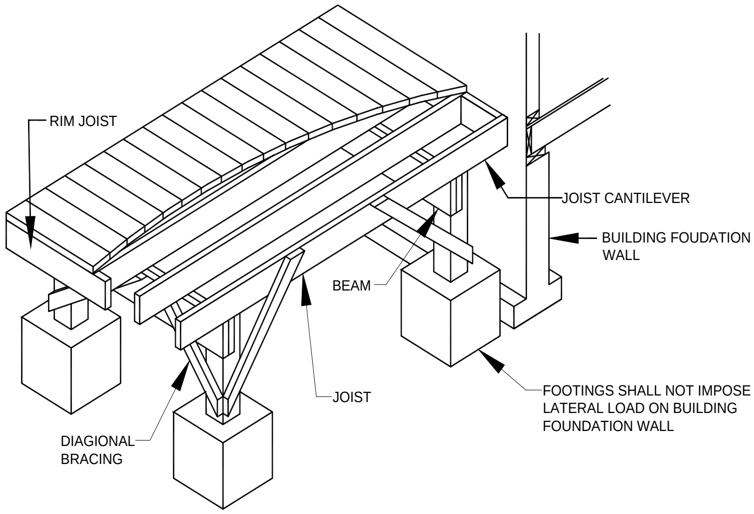
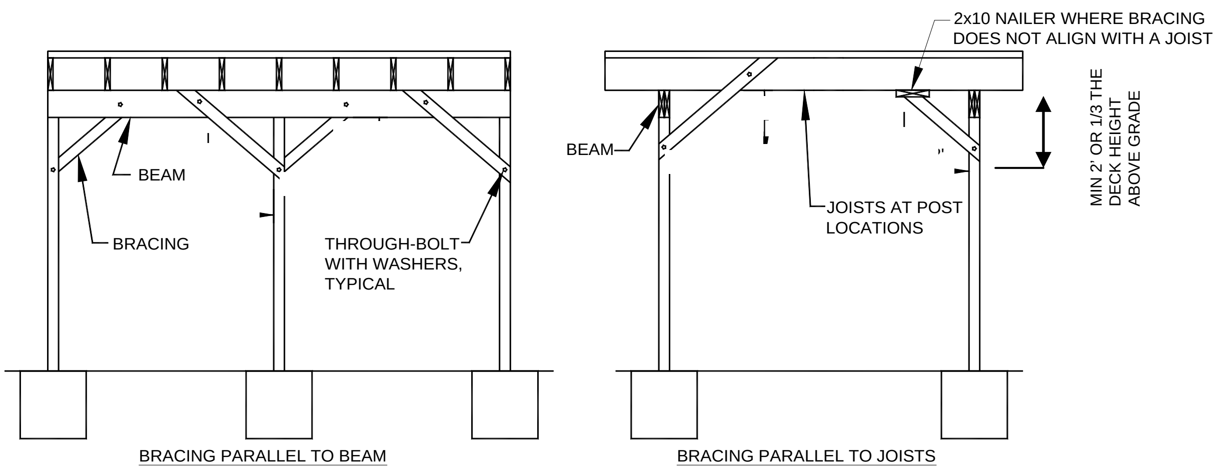


FIGURE R507.10
FREE-STANDING DECK

R507.10.1 Diagonal bracing. Diagonal bracing shall be installed on free-standing decks greater than 30 inches (762 mm) above grade in accordance with Figure R507.10.1. Bracing shall be placed at a 45 degree angle at each post location in the parallel and perpendicular directions to the beam. Bracing shall be a minimum of nominal 2x4 lumber and shall be fastened to framing with one 1/2 inch (9 mm) diameter through bolt with washers at each end. The diagonal brace shall be a minimum of 2 feet long measured as shown in Figure R507.10.1 or at least 1/3 the height of the deck above grade.

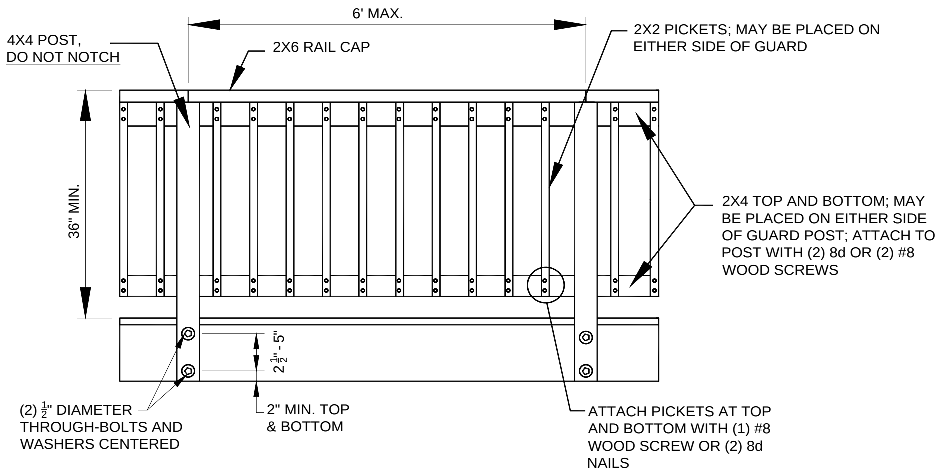


For SI: 1 foot = 304.8 mm

FIGURE R507.10.1
FREE-STANDING DECK DIAGONAL BRACING

R507.12 Deck guards. Deck guards shall be designed and constructed in accordance with Sections R301.5 and R312. Other materials and construction techniques shall be permitted in accordance with Section R301.

R507.12.1 Guard construction. Where the guard requirements of Sections R301.5 and R312 are met using the details shown in Figures R507.12.1(1) through R507.12.1(3), guard posts shall be attached to the inside or outside face of the rim joist or end joist. Hold-down anchors shall have a minimum capacity of 1,800 pounds (8006 N).



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

FIGURE R507.12.1(1)
DECK GUARD

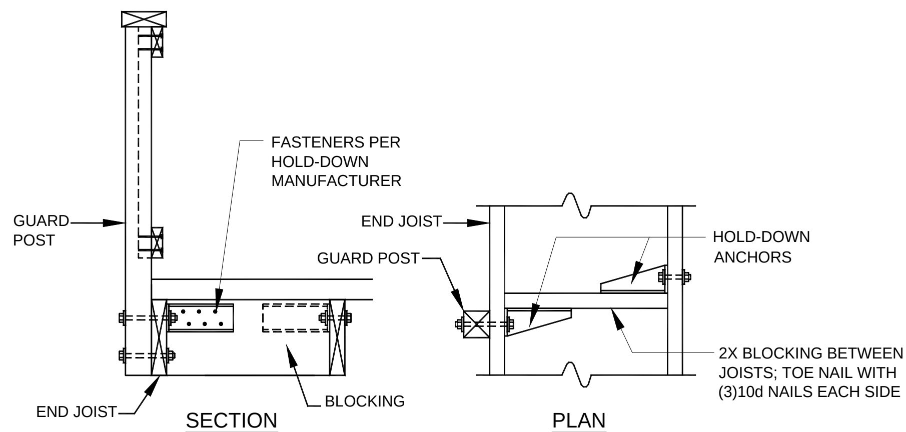


FIGURE R507.12.1(2)
GUARD POST TO END JOIST

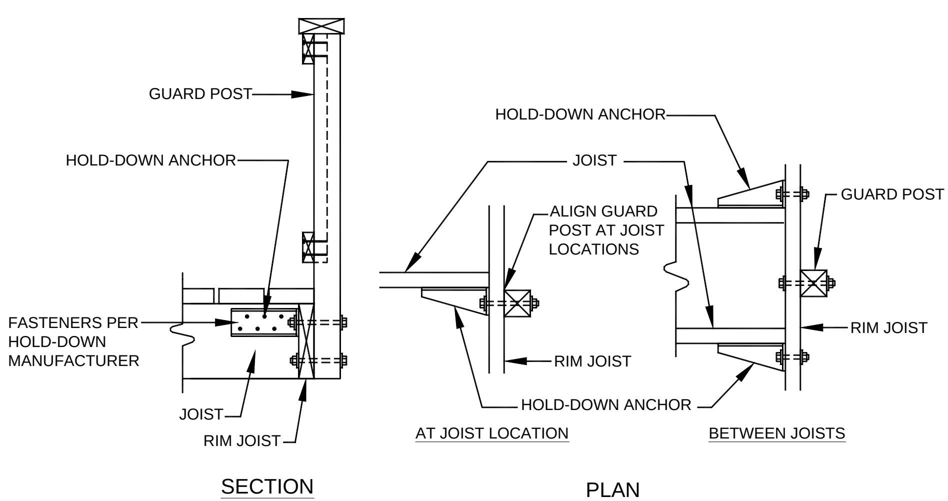
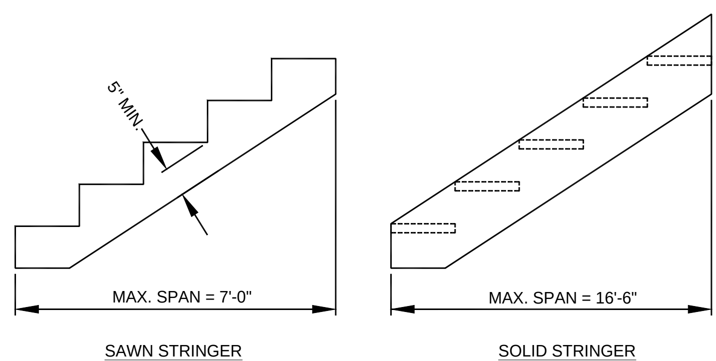


FIGURE R507.12.1(3)
GUARD POST TO RIM JOIST

R507.13 Deck stairs. Deck stairs shall be constructed in accordance with this section and Section R311.7. Where a flight of stairs has a vertical rise greater than that allowed per Section R311.7.3, an intermediate landing shall be provided in accordance with Section R311.7.6 and designed as a free-standing deck in accordance with Section R507.10.

R507.13.1 Stair stringers. Stair stringers shall be constructed of sawn nominal 2x12 members at 18 inches (457 mm) on center with a throat dimension of 5 inches (127 mm) and a maximum span length as shown in Figure R507.13.1. Stairs with a width equal to 36 inches (914 mm) shall be permitted to be constructed with two solid 2x12 stringers with a maximum span length as shown in Figure R507.13.1.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

FIGURE R507.13.1
STAIR STRINGER REQUIREMENTS

R507.13.2 Stringer bearing. Stringers shall be attached to posts or bear on joist hangers attached to the deck structure and on footings at grade in accordance with Figure R507.13.2. Joist hangers shall be specifically designed to accommodate sloped connections and shall have a minimum capacity of 625 pounds (2780 N). Reinforcing angles at rim joist locations only shall have a minimum capacity of 325 pounds (1446 N).

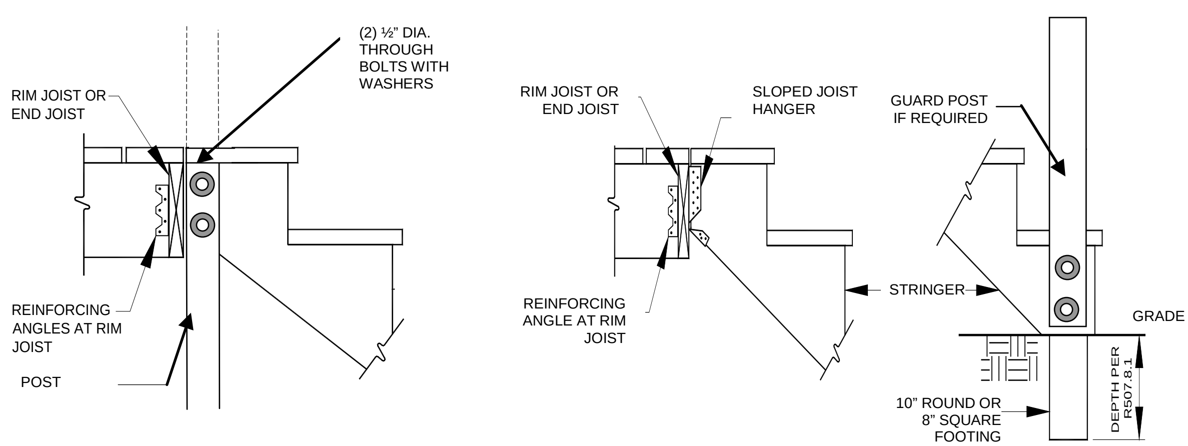


FIGURE R507.13.2
STRINGER BEARING

R507.13.3 Treads and risers. Stair treads shall be constructed in accordance with Section R311.7 and Figure R507.13.3. Treads shall be composed of nominal 2x6 lumber. Treads of stairs constructed with solid stringers shall be permitted to be composed of span rated decking. Risers shall be permitted to be composed of nominal 1x lumber. Openings in risers shall not allow the passage of a 4 inch (102 mm) diameter sphere.

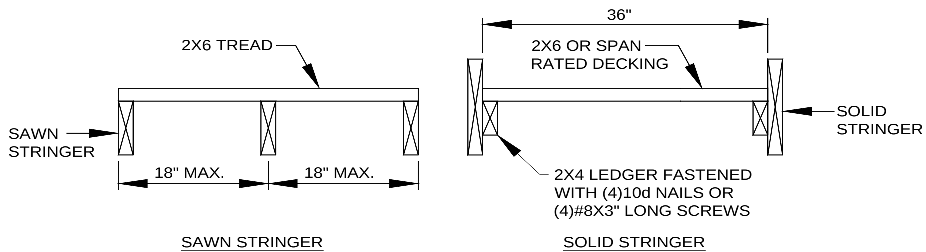
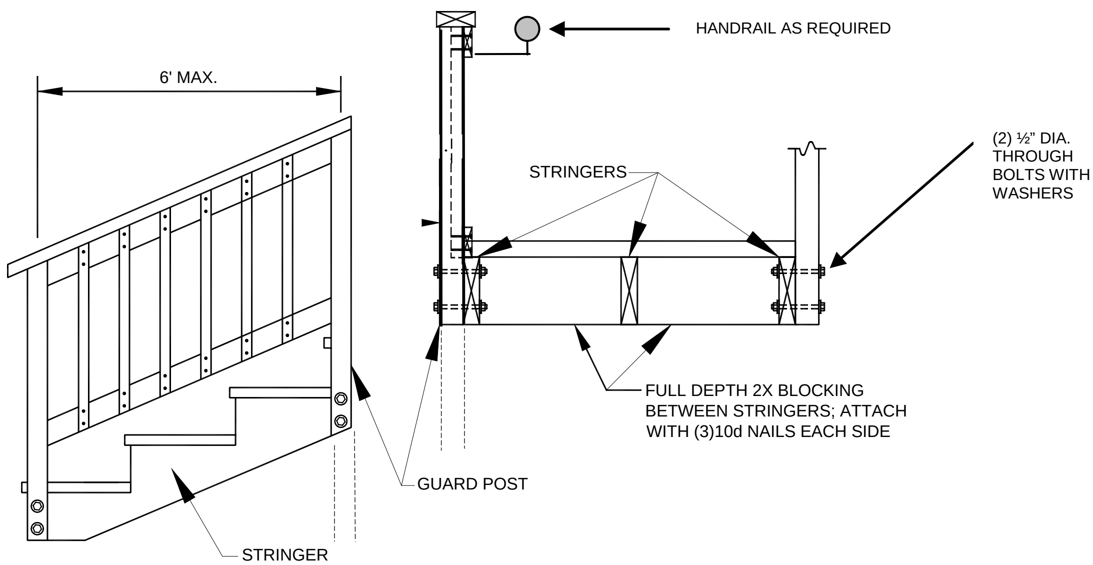


FIGURE R507.13.3
TREAD REQUIREMENTS

R507.13.4 Stair guard. Guards for stairs shall be as required per Section R312.1.1 and constructed in accordance with Section R507.12. The attachment of a stair guard post to the stringers shall be constructed in accordance with Figure R507.13.4.



For SI: 1 foot = 304.8 mm

FIGURE R507.13.4
STAIR GUARD CONNECTION

R507.13.5 Stair handrails. When required, handrails for stairs shall be as required per Section R311.7.8. When required and where the top guard rail does not comply with the handrail grip-size requirements in Section R311.7.8.3, a separate, conforming handrail shall be required.

R507.13.6 Ramps. Ramps from decks shall be as required in Section R311.8. Details for stringers, guards and handrails shall be similar to those for stairs.

Reason: With the increasing attention being paid to deck safety, the 2012 IRC took a major step forward by establishing a new Section R507 that covers deck construction. However, Section R507 consists almost entirely of connection details for anchoring the deck to the house, and does not provide any prescriptive requirements for building the deck itself. Some information is completely missing, like joist spans for naturally durable wood species, joist spans for wet lumber, beam spans, post sizes, bracing, footings and stair stringer spans.

Currently about one-third of the building permits pulled in our county are for decks. A significant number of these decks are built by homeowners or "handymen", rather than professional deck or home builders. Since the current code provides them no prescriptive guidelines, many jurisdictions across the country have tried to help either by creating locally developed deck guides or by directing the homeowner/builder to the *Prescriptive Residential Wood Deck Construction Guide (DCA6)*, a free document published by the American Wood Council (AWC).

Background on the *DCA6:* it is a document that originated in August 2006 when an ad-hoc task group was created to address prescriptive provisions for residential wood deck construction. While not a true consensus standard committee, the group was fairly balanced with representatives of ICC, AWC, home builders, municipal representative from Fairfax County, VA, construction hardware manufacturers, and the truss industry represented. The provisions of the *DCA6* gather requirements from throughout the IRC into one place, whether they be prescriptive requirements already contained in other sections, or new solutions derived from the performance provisions. A *Commentary* is also included in the document, to give the user an understanding of the data and/or experience upon which the provision is based.

While deck guides written outside the code development process have served a purpose, we think it is important that a set of deck construction provisions be contained in the IRC itself.

This submittal is based largely upon the provisions of the *DCA6*, with the intent to create a simple yet complete deck code section that provides prescriptive methods for safe deck construction. The submittal is presented in a simplified format so that it can be used by building officials, builders, inspectors and homeowners. The proponents recognize that every possible construction detail or condition is not covered by this submittal – the intent is to provide permitted methods for meeting the code, and not to preclude the use of other construction methods or materials that can always approved by the authority having jurisdiction using R104.11 or R301.

I have been privy to several other alternate deck proposals that are being considered for the 2015 IRC. My thought is that these proposals are well intentioned, but essential components were omitted for political reasons. Along with members of industry, I have developed what I believe to be a cleaner, more organized, more complete proposal with most of the same provisions of these other drafts and *DCA6* without the worry that some provisions might be politically improper to some constituents.

In conclusion, the average deck builder, plan reviewer and inspector have nothing in the IRC to help them with a deck design. Homeowners and non-professionals need to have simple prescriptive methods for building a safe deck, and we believe this proposal provides those guidelines.

Bibliography:

DCA6. http://www.awc.org/publications/DCA/DCA6/DCA6-09.pdf

Cost Impact: The code change proposal may increase the cost of construction.

RB268-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R507-RB-BAJNAI-SHACKELFORD.doc

RB269 – 13
R602.1 (NEW), R602.1.5 (NEW), R602.1.6 (NEW), R602.3

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R602.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

~~**R602.1**~~ **R602.1.1** ~~**Identification.**~~**Sawn Lumber.** ~~Load-bearing dimension~~ Sawn lumber ~~for studs, plates and headers~~ shall be identified by a grade mark of ~~a~~ an accredited lumber grading or inspection agency ~~that has been *approved*~~ and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certification of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

R602.1.5 Wood structural panels. Wood structural panel sheathing shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and Performance Category by a grade mark or certificate of inspection issued by an approved agency.

R602.1.6 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approve agency.

R602.1.7 Fiberboard. Fiberboard shall conform to ASTM C208. Fiberboard sheathing, when used structurally, shall be identified by an approved agency as conforming to ASTM C208.

R602.3 Design and construction. Exterior walls of wood frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, when placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3)~~. Wood structural panel sheathing used for exterior walls shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and Performance Category by a grade mark or certificate of inspection issued by an approved agency~~ and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703. Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Reason: The change is intended to clarify the process by which lumber design values are certified and recognized in the code. The current process, which has been used since 1970, relies on the internationally recognized U.S.Department of Commerce Voluntary Product Standard PS20. Because the current format of the section can be incorrectly interpreted to place a number of wood products under the identification requirements of PS20, a new format is proposed that clearly states this standard is only for sawn lumber. The format proposed is nearly identical to what is used in Section 2302 of the International Building Code. Wood products other than sawn lumber have unique manufacturing standards, design value development, and quality control criteria. This new format clarifies that these other wood products must comply with specific product standards. Product standards that are currently buried in Section R602.3, Design and construction, are relocated into R602.1.

Cost Impact: The code change will not increase the cost of construction.

RB269-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.1 (NEW)-RB-PITTS.doc

RB270 – 13
R602.3, R602.4

Proponent: Dennis St. Denis, D & L Quality Homes, representing self (lstdenis2@cogeco.ca)

Revise as follows:

R602.3 Design and construction. Exterior walls of woodframe construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, when placed on the exterior side of an exterior wall shall be capable of resisting the wind pressures listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3). Wood structural panel sheathing used for exterior walls shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O437 or CSA O325. All panels shall be identified for grade, bond classification, and performance Category by a grade mark or certificate of inspection issued by an approved agency and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703.

Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice. <u>Load Bearing Warning Signs shall be installed on every second stud along the full length of the load bearing wall, at a height of 5 feet and attached with screws or nails.</u>

> **Exception:** Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables R502.5(1) and R502.5(2).

R602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fireblocked <u>and Load Bearing Warning Signs installed</u> as specified for exterior walls.

Reason: Load Bearing Walls and Load Points are being removed by homeowners and contractors during renovations and also being cut into by sub-contractors during new home construction or renovations without knowing what the possible outcome can be. The resulting problems are people being severly injured, ceilings and/or roofs collapsing and fatalities. All of this can be avoided if these SAFETY WARNING SIGNS were enforced as a building code.

Cost Impact: This code change proposal will increase the cost of construction.

RB270-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3-RB-STDENIS.doc

RB271 – 13

Table R602.3(1), Table R602.3(2), Table R602.3(3), Table R602.3.1, R602.3.5, Table R602.10.1.3, Table R602.10.3(1), Table R602.10.4, R602.10.4.1, Table R602.10.5, Table R602.10.6.1, Table R602.10.6.4, R602.10.6.5.1, R602.10.8.2, R602.12, R612.2, R613.2, Table R613.5(1), Table R613.5(2)

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB); Jay Crandell, P.E., ARES Consulting; Ed Keith, P.E., APA – The Engineered Wood Association

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

f. For regions having basic wind speed of ~~110~~ 140 mph or greater, 8d deformed (2½″ × 0.120) nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.

g. For regions having basic wind speed of ~~100~~ 130 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. When basic wind speed is greater than ~~100~~130 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.

(Portions of Table not shown remain unchanged)

TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE 602.3(1)

g. Specified alternate attachments for roof sheathing shall be permitted for windspeeds less than ~~100~~ 130 mph. Fasteners attaching wood structural panel roof sheathing to gable end wall framing shall be installed using the spacing listed for panel edges.

(Portions of Table not shown remain unchanged)

TABLE R602.3(3)
REQUIREMENTS FOR WOOD STRUCTRUAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES [a,b,c]

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		~~MAXIMUM~~ ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind Exposure Category		
							B	C	D
6d Common (2.0" x 0.113")	1.5	24/0	3/8	16	6	12	~~110~~ 140	~~90~~ 130	~~85~~ 115
8d Common (2½" x 0.131")	1.75	24/16	7/16	16	6	12	~~130~~ 170	~~110~~ 140	~~105~~ 135
				24	6	12	~~110~~ 140	~~90~~ 115	~~85~~ 110

For SI: 1 Inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

b. Table is based on wind pressures acting toward and away from building surfaces per Section R301.2. Lateral bracing requirements shall be in accordance with Section R602.10.

c. Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternative to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 o.c .shall be used with studs spaced a maximum of 16 inches on center.

TABLE R602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO WIND SPEEDS OF ~~100~~ 130 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C, D_0, D_1 and D_2 [b, c]

(Portions of table not shown remain unchanged)

R602.3.5 Braced wall panel uplift load path. *Braced wall panels* located at exterior walls that support roof rafters or trusses (including stories below top *story*) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
   1.1. The ~~basic~~ ultimate design wind speed does not exceed ~~90~~ 115 mph (~~40~~ 51 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, or
   1.2. The net uplift value at the top of a wall does not exceed 100 plf. The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing *approved* uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2 above.
3. Wall sheathing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.

TABLE R602.10.1.3
BRACED WALL LINE SPACING

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind Bracing	~~85 mph to < 110 mph~~ Ultimate Design Wind Speed 100 mph to < 140 mph	Detached, townhouse	60 feet	None

(Portions of Table not shown remain unchanged)

~~TABLE R602.10.3(1)~~
~~BRACING REQUIREMENTS BASED ON WIND SPEED~~

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

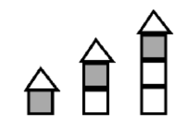
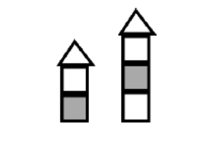
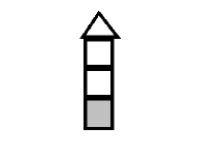
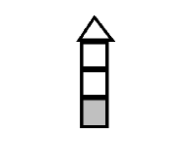
• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT WALL HEIGHTS • 2 BRACED WALL LINES			MINIMUM TOTALLENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB[b]**	**Method GB**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB[c]**	**Methods CS-WSP, CS-G, CS-PF**
≤110		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.5	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.5	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.5	15.5
		50	NP	39.5	22.5	19.0
		60	NP	46.5	26.5	23.0
≤115		10	3.5	3.5	2.0	2.0
		20	6.5	6.5	3.5	3.5
		30	9.5	9.5	5.5	4.5
		40	12.5	12.5	7.0	6.0
		50	15.0	15.0	9.0	7.5
		60	18.0	18.0	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	12.5	12.5	7.5	6.5
		30	18.0	18.0	10.5	9.0
		40	23.5	23.5	13.5	11.5
		50	29.0	29.0	16.5	14.0
		60	34.5	34.5	20.0	17.0
		10	NP	10.0	6.0	5.0
		20	NP	18.5	11.0	9.0
		30	NP	27.0	15.5	13.0
		40	NP	35.0	20.0	17.0
		50	NP	43.0	24.5	21.0
		60	NP	51.0	29.0	25.0

TABLE R602.10.3(1)-continued
BRACING REQUIREMENTS BASED ON WIND SPEED

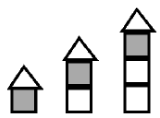
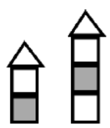
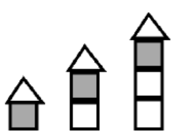
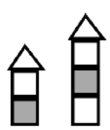
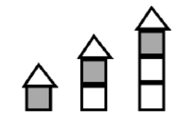
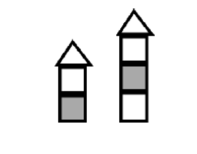
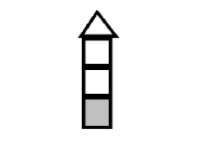
• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT WALL HEIGHTS • 2 BRACED WALL LINES			MINIMUM TOTALLENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Method LIB[b]**	**Method GB**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB[c]**	**Methods CS-WSP, CS-G, CS-PF**
≤120		10	4.0	4.0	2.5	2.0
		20	7.0	7.0	4.0	3.5
		30	10.5	10.5	6.0	5.0
		40	13.5	13.5	8.0	6.5
		50	16.5	16.5	9.5	8.0
		60	19.5	19.5	11.5	9.5
		10	7.5	7.5	4.5	3.5
		20	14.0	14.0	8.0	7.0
		30	20.0	20.0	11.5	9.5
		40	25.5	25.5	15.0	12.5
		50	31.5	31.5	18.0	15.5
		60	37.5	37.5	21.5	18.5
		10	NP	11.0	6.5	5.5
		20	NP	20.5	11.5	10.0
		30	NP	29.0	17.0	14.5
		40	NP	38.0	22.0	18.5
		50	NP	47.0	27.0	23.0
		60	NP	55.5	32.0	27.0
≤130		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.5	19.5	11.0	9.5
		60	23.0	23.0	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.5	8.0
		30	23.0	23.0	13.5	11.5
		40	30.0	30.0	17.5	15.0
		50	37.0	37.0	21.5	18.0
		60	44.0	44.0	25.0	21.5
		10	NP	13.0	7.5	6.5
		20	NP	24.0	13.5	11.5
		30	NP	34.5	19.5	17.0
		40	NP	44.5	25.5	22.0
		50	NP	55.0	31.5	26.5
		60	NP	65.0	37.5	31.5

TABLE R602.10.3(1)-continued
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT WALL HEIGHTS • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Method LIB[b]	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB[c]	Methods CS-WSP, CS-G, CS-PF
<140		10	5.5	5.5	3.0	2.5
		20	10.0	10.0	5.5	5.0
		30	14.0	14.0	8.0	7.0
		40	18.0	18.0	10.5	9.0
		50	22.5	22.5	13.0	11.0
		60	26.5	26.5	15.0	13.0
		10	10.0	10.0	6.0	5.0
		20	18.5	18.5	11.0	9.0
		30	27.0	27.0	15.5	13.0
		40	35.0	35.0	20.0	17.0
		50	43.0	43.0	24.5	21.0
		60	51.0	51.0	29.0	25.0
		10	NP	15.0	8.5	7.5
		20	NP	27.5	16.0	13.5
		30	NP	39.5	23.0	19.5
		40	NP	51.5	29.5	25.0
		50	NP	63.5	36.5	31.0
		60	NP	75.5	43.0	36.5

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.
a. Linear interpolation shall be permitted.
b. Method LIB shall have gypsum board fastened to at least one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
c. Method CS-SFB does not apply where the ultimate design wind speed is greater than 130 mph.

TABLE R602.10.4
BRACING METHODS

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.
a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.
b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load may not exceed 3 psf.
c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.
d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 and in areas where the ultimate design wind speed exceeds ~~100~~ 130 mph.
e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.

(Portions of Table not shown remain unchanged)

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from *braced wall line* to *braced wall line* within a story shall be permitted. Within Seismic Design Categories A, B and C or in regions where the ~~basic~~ ultimate design wind speed is less than or equal to ~~100~~ 130 mph (~~45~~ 58 m/s), mixing of intermittent

bracing and continuous sheathing methods from *braced wall line* to braced wall line within a story shall be permitted.

3. Mixing intermittent bracing methods along a *braced wall line* shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a *braced wall line* with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same *braced wall line* shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the *braced wall line*.

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD (See Table R602.10.4)		**MINIMUM LENGTH (inches) Wall Height**					**CONTRIBUTING LENGTH (inches)**
		8 feet	**9 feet**	**10 feet**	**11 feet**	**12 feet**	
ABW	SDC A, B, and C, Ultimate design wind speed <~~110~~ 140 mph	28	32	34	38	42	48
	SDC D_0, D_1 and D_2, Ultimate design wind speed <~~110~~ 140 mph	32	32	34	NP	NP	

(Portions of Table not shown remain unchanged)

TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	**SUPPORTING/ STORY**	**HOLD DOWN FORCE (pounds) Height Of Braced Wall Panel**				
		8 feet	**9 feet**	**10 feet**	**11 feet**	**12 feet**
SDC A, B, and C Ultimate design wind speed <~~110~~ 140 mph	One story	1,800	1,800	1,800	2,000	2,200
	First of two stories	3,000	3,000	3,000	3,300	3,600
SDC D_0, D_1, and D_2 Ultimate design wind speed <~~110~~ 140 mph	One story	1,800	1,800	1,800	NP	NP
	First of two stories	3,000	3,000	3,000	NP	NP

~~**TABLE R602.10.6.4**~~
~~**TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES**~~
~~**PERPENDICULAR TO METHODS PFH, PFG, AND CS-PF BRACED WALL PANELS**~~

TABLE R602.10.6.4
TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES PERPENDICULAR TO METHODS PFH, PFG, AND CS-PF BRACED WALL PANELS

MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (feet)	MAXIMUM TOTAL WALL HEIGHT (feet)	MAXIMUM OPENING WIDTH (feet)	TENSION STRAP CAPACITY REQUIRED (pounds)[a,b] Ultimate Design Wind Speed V_{ult} (mph)					
				110	115	130	110	115	130
				Exposure B			Exposure C		
2 X 4 No. 2 Grade	0	10	18	1,000	1,000	1,000	1,000	1,000	1,050
	1	10	9	1,000	1,000	1,000	1,000	1,000	1,750
			16	1,000	1,025	2,050	2,075	2,500	3,950
			18	1,000	1,275	2,375	2,400	2,850	DR
	2	10	9	1,000	1,000	1,475	1,500	1,875	3,125
			16	1,775	2,175	3,525	3,550	4,125	DR
			18	2,075	2,500	3,950	3,975	DR	DR
	2	12	9	1,150	1,500	2,650	2,675	3,175	DR
			16	2,875	3,375	DR	DR	DR	DR
			18	3,425	3,975	DR	DR	DR	DR
	4	12	9	2,275	2,750	DR	DR	DR	DR
			12	3,225	3,775	DR	DR	DR	DR
2 X 6 Stud Grade	2	12	9	1,000	1,000	1,700	1,700	2,025	3,050
			16	1,825	2,150	3,225	3,225	3,675	DR
			18	2,200	2,550	3,725	3,750	DR	DR
	4	12	9	1,450	1,750	2,700	2,725	3,125	DR
			16	2,050	2,400	DR	DR	DR	DR
			18	3,350	3,800	DR	DR	DR	DR

For SI: 1 Inch = 25.4 mm, 1 mile per hour = 0.447 m/s.
a. DR = design required.
b. Straps shall be installed in accordance with manufacturer's recommendations.

R602.10.6.5.1 Length of bracing. The length of bracing along each *braced wall line* shall be the greater of that required by the ultimate design wind speed and *braced wall line* spacing in accordance with Table R602.10.3(1) as adjusted by the factors in the Table R602.10.3(2) or the Seismic Design Category and *braced wall line* length in accordance with Table R602.10.6.5. Angled walls shall be permitted to be counted in accordance with Section R602.10.1.4, and *braced wall panel* location shall be in accordance with Section R602.10.2.2. The seismic adjustment factors in Table R602.10.3(4) shall not be applied to the length of bracing determined using Table R602.10.6.5. In no case shall the minimum total length of bracing in a *braced wall line*, after all adjustments have been taken, be less than 48 inches (1219 mm) total.

R602.10.8.2 Connections to roof framing. Top plates of exterior *braced wall panels* shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of *braced wall panel*s and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the *braced wall panels* shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously-sheathed *braced wall lines*. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with Section R806.1.

1. For Seismic Design Categories A, B and C and ultimate design wind speeds less than ~~100~~ 130 mph (~~45~~ 58 m/s) where the distance from the top of the *braced wall panel* to the top of the rafters

or roof trusses above is 9¼ inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses above is between 9¼ inches (235 mm) and 15¼ inches (387 mm), blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.8.2(1).

2. For Seismic Design Categories D_0, D_1 and D_2 or <u>ultimate design</u> wind speeds of ~~100~~ <u>130</u> mph (~~45~~ <u>58</u> m/s) or greater, where the distance from the top of the *braced wall panel* to the top of the rafters or roof trusses is 15¼ inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the *braced wall panel* in accordance with Figure R602.10.8.2(1).
3. Where the distance from the top of the *braced wall panel* to the top of rafters or roof trusses exceeds 15¼ inches (387 mm), the top plates of the *braced wall panel* shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:
   - 3.1. Soffit blocking panels constructed in accordance with Figure R602.10.8.2(2);
   - 3.2. Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3);
   - 3.3. Full-height engineered blocking panels designed in accordance with the AF&PA WFCM; or
   - 3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with accepted engineering practice.

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed in items 1-8 shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All exterior walls shall have gypsum board with a minimum thickness of ½ inch (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the ~~basic~~ <u>ultimate design</u> wind speed is less than or equal to ~~90~~ <u>115</u> mph (~~40~~ <u>51</u> m/s), and the Exposure Category is A or B.
7. The structure shall be located in Seismic Design Category A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in two-story buildings.

R612.2 Performance. Exterior windows and doors shall be designed to resist the design wind loads specified in Table R301.2(2) adjusted for height and exposure in accordance with Table R301.2(3) <u>or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code.*</u>

R613.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum <u>ultimate</u> design wind speed <u>(V_{ult})</u> of ~~120~~ <u>155</u> miles per hour (~~54~~ <u>69</u> m/s), Exposure A or B or ~~110~~ <u>140</u> miles per hour (~~49~~ <u>63</u> m/s) Exposure C, and a maximum ground snow load of 70 pounds per foot (3.35 kPa), and Seismic Design Categories A, B and C.

~~**TABLE R613.5(1)**~~
~~**MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ROOF ONLY (inches)**~~

TABLE R613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ROOF ONLY (inches)

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)														
			24			28			32			36			40		
			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)		
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
110	--	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5
115	--	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
130	110	20	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
		30	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR
		50	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR
		70	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR
140	120	20	4.5	6.5	DR	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR
		30	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR
		50	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		70	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR

For SI: 1 Inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.
DR = design required.
a. Design Assumptions:
Deflection criteria: *L/240.*
Roof load: *7 psf.*
Ceiling load: *5 psf.*
Wind loads based on Table R301.2(2).
Strength axis of facing material applied vertically.

~~**TABLE R613.5(2)**~~
~~**MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF ONLY (inches)**~~

TABLE R613.5(2)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF ONLY (inches)

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)														
			24			28			32			36			40		
			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)		
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
110	--	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR
		50	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR
		70	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
115	--	20	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR
		30	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		SNOW LOAD (psf)	BUILDING WIDTH (ft)														
			24			28			32			36			40		
Exp. B	Exp. C		Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)		
			8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
		50	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR
		70	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
120	--	20	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR
		30	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR	DR	DR	DR
		50	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
		70	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
130	110	20	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR
		30	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		50	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		70	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR

For SI: 1 Inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.
DR = design required.
a. Design Assumptions:
Deflection criteria: *L/240.*
Roof load: *7 psf.*
Ceiling load: *5 psf.*
Second floor live load: *30 psf.*
Second floor dead load: *10 psf.*
Second floor dead load from walls: *10 psf.*
Wind loads based on Table R301.2(2).
Strength axis of facing material applied vertically.

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates the Chapter 6 provisions, including triggers in the wall bracing provisions, the wind bracing table, the header strap for the portal frames, and the structural insulated panel applicability limits and design tables. It is noted that the changes necessary to update the appropriate Section R603 cold-formed steel provisions are contained in a separate AISI proposal which comprehensively revises the cold-formed steel provisions. The changes necessary to update the appropriate Section R611 above-grade concrete wall provisions are contained in a separate PCA proposal.

Cost Impact: This code change proposal will not increase the cost of construction.

RB271-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB272 – 13
Table R602.3(1)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

Table R602.3(1)
FASTENING SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS
		Roof	
1	Blocking between ceiling joists or rafters to top plate, toe nail	~~3-8d~~ 4-8d box (2½ " x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—
2	Ceiling joists to top plate, toe nail	~~3-8d~~ 4-8d box (2½ " x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—
3	Ceiling joist not attached to parallel rafter, laps over partitions, face nail	~~3-10d~~ 4-10d box (3"x 0.128"); or 3-16d common (3½" x 0.162"); or 4-3" x 0.131" nails	—
4	Collar tie to rafter, face nail or 1 1/4" x 20 gage ridge strap	~~3-10d~~ 4-10d box (3"x0.128"); or 3-10d common (3" x 0.148"); or 4-3" x 0.131" nails	—
5	Rafter or roof truss to plate, toe nail	3-16d box nails (3½" x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[j]
6	Roof rafters to ridge, valley or hip rafters~~:~~ ~~toe nail face nail~~	4-16d box (3½ " x 0.135"); or 3-10d common (3½" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails 3-16d box (3½ " x 0.135") 2-16d common (3½" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Toenail Endnail
		Wall	
7	Built-up studs—face nail	~~10d (3" x 0.128")~~ 16d common (3½" x 0.162") 10d box (3" x 0.128"); or 3" x 0.131" nails	24" o.c. 16" o.c.
8	Abutting studs at intersecting wall corners, face nail	16d box (3 ½ " x 0.135"); or 3" x 0.131" nails 16d common (3½" x 0.162")	12" o.c. 16" o.c.
9	Built-up header, two pieces with 1/2″ spacer	~~16d (3½" × 0.135")~~ 16d common (3½" x 0.162") 16d box (3½" x 0.135")	16″ o.c. along each edge 12" o.c. along each edge

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS
10	Continued header, two pieces	~~16d (3½″ × 0.135″)~~ 16d common (3½" x 0.162") 16d box (3½" x 0.135")	16″ o.c. along each edge 12" o.c. along each edge
11	Continuous header to stud, toe nail	~~4-8d~~ 5-8d box (2½ ″ × 0.113″); or 4-8d common (2½" x 0.131"); or 4-10d box (3" x 0.128")	—
12	Double studs, face nail	~~10d (3″ × 0.128″)~~ 16d common (3½" x 0.162") 10d box (3" x 0.128"); or 3" x 0.131" nails	24″ o.c. 16" o.c.
13	Double top plates, face nail	~~10d (3″ × 0.128″)~~ 16d common (3½" x 0.162") 10d box (3" x 0.128"); or 3" x 0.131" nails	~~24″ o.c.~~ 16" o.c. 12" o.c.
14	Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	~~8-16d (3 ½ ″ × 0.135″)~~ 8-16d common (3½" x 0.162"); or 12-16d box (3½" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails	—
15	Sole plate to joist or blocking, face nail	~~16d (3½ ″ × 0.135″)~~ 16d common (3½" x 0.162") 16d box (3½" x 0.135"); or 3" x 0.131" nails	16″ o.c. 12" o.c.
16	Sole plate to joist or blocking at braced wall panels	3-16d box (3½″ × 0.135″); or 2-16d common (3½" x 0.162"); or 4-3" x 0.131" nails	16″ o.c.
17	Stud to sole plate, toe nail	~~3-8d~~ 4-8d box (2½″ × 0.113″);or ~~2-16d~~ 3-16d box (3½″ × 0.135″); or 4-8d common (2½" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	—
18	Top or sole plate to stud, end nail	~~2-16d~~ 3-16d box (3½″ × 0.135″); or 2-16d common (3½" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—
19	Top plates, laps at corners and intersections, face nail	~~2-10d~~ 3-10d box (3″ × 0.128″); or 2-16d common (3½" x 0.162"); or 3-3" x 0.131" nails	—
20	1″ brace to each stud and plate, face nail	~~2-8d~~ 3-8d box (2½″ × 0.113″); or 2-8d common (2½" x 0.131"); or 2-10d box (3" x 0.128") 2 staples 1¾″	—
21	1″ × 6″ sheathing to each bearing, face nail	~~2-8d~~ 3-8d box (2½″ × 0.113″); or 2-8d common (2½" x 0.131"); or 2-10d box (3" x 0.128") 2 staples 1¾″	—
22	1″ × 8″ sheathing to each bearing, face nail	~~2-8d~~ 3-8d box (2½″ × 0.113″); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128") 3 staples 13/4″	—

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS
23	Wider than 1″ × 8″ sheathing to each bearing, face nail	~~3-8d~~ 4-8d box (2½″ × 0.113″); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128") 4 staples 1¾"	—
	Floor		
24	Joist to sill or girder, toe nail	~~3-8d~~ 4-8d box (2½″ × 0.113″); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—
25	Rim joist to top plate, toe nail (roof applications also)	8d box (2½″ × 0.113″) 8d common (2½" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	4" o.c. 6″ o.c.
26	Rim joist or blocking to sill plate, toe nail	8d box (2½″ × 0.113″) 8d common (2½" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	4" o.c. 6″ o.c.
27	1″ × 6″ subfloor or less to each joist, face nail	~~2~~ 3-8d box (2½″ × 0.113″); or 2-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128") 2 staples 1¾″	—
28	2″ subfloor to joist or girder, blind and face nail	~~2-16d~~ 3-16d box (3½″ × 0.135″); or 2-16d common (3½" x 0.162")	—
29	2″ planks (plank & beam - floor & roof)	~~2-16d~~ 3-16d box (3½″ × 0.135″); or 2-16d common (3½" x 0.162")	at each bearing
30	Built-up girders and beams, 2-inch lumber layers	~~10d (3″ × 0.128″)~~ 20d common (4" x 0.192"); or 10d box (3" x 0.128"); or 3" x 0.131" nails And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Nail each layer as follows: 32″ o.c. at top and bottom and staggered. ~~Two nails at ends and at each splice.~~ 24" o.c. face nail at top and bottom staggered on opposite sides Face nail at ends and at each splice
31	Ledger strip supporting joists or rafters	~~3-16d~~ 4-16d box (31/2″ × 0.135″); or 3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	At each joist or rafter

(Portions of Table not shown remain unchanged)

Reason: This proposed change seeks greater consistency between the IRC Table R602.3(1) wood frame nailing schedule and IBC Table 2304.9.1, as it will appear in the 2015 edition of the IBC (see S265). This proposed change results in minimum size and number of fasteners per connection to be substantially the same between the IRC and the IBC creating increased consistency of minimum nailing requirements for wood frame construction. Proposed nailing requirements are also clearer because the exact dimensions of commonly used power driven, box, and common nail sizes are shown in the table.

Complete consistency between the actual nailing specified in the two codes is not achieved by this proposal. One reason is because the proposed revisions retain the currently tabulated IRC nail sizes, such as 2-1/2" long x 0.113" diameter box nails, as an option. While the smaller nail size in the IRC table does not appear in IBC Table 2304.9.1, retention of the smaller nail size was judged as important for continuity from one code edition to another.

In several cases, the IRC minimum nailing remains unchanged by this proposal except for addition of IBC nailing options. For instance, the base nailing of the following remain unchanged: Item 5, Rafter or roof truss to plate; Item 6, Roof rafters to ridge, valley or hip rafters; Item 8, Abutting studs at intersecting wall corners; and Item 16, Sole plate to joist or blocking at braced wall panels. In all other cases, there is an increase in number of smaller nails by 1 or there is a reduced spacing in order to maintain a minimum connection of approximately equal strength to that provided by the IBC nailing. Reference design values in accordance with NDS for wood construction for the various applications are compared in the following Table 1 – Reference Nail Values for Proposed Minimum Nailing. All values are based on normal load duration and calculated assuming framing with Specific Gravity equal to 0.42.

Table 1 – Reference Nail Values for Proposed Minimum Nailing

	DESCRIPTION	NUMBER AND TYPE OF FASTENER		REFERENCE LATERAL VALUE	REFERENCE WITHDRAWAL VALUE
		Roof			
1	Blocking between ceiling joists or rafters to top plate, toe nail	4-8d box (2 ½ " x 0.113"); or 3-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	--	200 lb 186 lb 195 lb 204 lb	
2	Ceiling joists to top plate, toe nail	4-8d box (2 ½ " x 0.113"); or 3-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	--	200 lb 186 lb 195 lb 204 lb	72 lb 63 lb 75 lb 78 lb
3	Ceiling joist not attached to parallel rafter, laps over partitions, face nail	4-10d box (3"x0.128"); or 3-16d common (3.5" x 0.162"); or 4-3" x 0.131" nails	—	316 lb 360 lb 328 lb	
4	Collar tie to rafter, face nail or 1 1/4" x 20 gage ridge strap	4 -10d box (3"x0.128"); or 3-10d common (3" x 0.148"); or 4-3" x 0.131" nails	—	316 lb 300 lb 328 lb	
5	Rafter or roof truss to plate, toe nail	3-16d box nails (3 ½" x 0.135"); or 3-10d common nails (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails		219 lb 240 lb 260 lb 272 lb	93 lb 87 lb 100 lb 104 lb
6	Roof rafters to ridge, valley or hip rafters	4-16d box (3 ½ " x 0.135"); or 3-10d common (3.5" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	Toenail	292 lb 240 lb 260 lb 272 lb	
		3-16d box (3 ½ " x 0.135") 2-16d common (3.5" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	Endnail	198 lb 180 lb 178 lb 185 lb	
		Wall			
7	Built-up studs—face nail	16d common (3.5" x 0.162")	24" o.c.	60 plf	
		10d box (3" x 0.128"); or 3" x 0.131" nails	16" o.c.	59 plf 62 plf	
8	Abutting studs at intersecting wall corners, face nail	16d box (3 ½ " x 0.135"); or 3" x 0.131" nails	12" o.c.	88 plf 82 plf	
		16d common (3.5" x 0.162")	16" o.c.	90 plf	
9	Built-up header, two pieces with 1/2″ spacer	16d common (3.5" x 0.162")	16″ o.c.	90 plf	
		16d box (3.5" x 0.135")	12" o.c.	88 plf	
10	Continued header, two pieces	16d common (3.5" x 0.162")	16″ o.c.	90 plf	
		16d box (3.5" x 0.135")	12" o.c.	88 plf	
11	Continuous header to stud, toe nail	5-8d box (2 ½ ″ × 0.113″); or 4-8d common (2.5" x 0.131"); or 4-10d box (3" x 0.128")	—	250 lb 248 lb 260 lb	
12	Double studs, face nail	16d common (3.5" x 0.162")	24″ o.c.	60 plf	
		10d box (3" x 0.128"); or 3" x 0.131" nails	16" o.c.	59 plf 62 plf	
13	Double top plates, face nail	16d common (3.5" x 0.162")	16" o.c.	90 plf	
		10d box (3" x 0.128"); or 3" x 0.131" nails	12" o.c.	79 plf 82 plf	
14	Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8-16d common (3.5" x 0.162"); or 12-16d box (3.5" x 0.135"); or 12-10d box (3" x 0.128"); or 12-3" x 0.131" nails	—	960 lb 1056 lb 948 lb 984 lb	

15	Sole plate to joist or blocking, face nail	16d common (3.5" x 0.162") 16d box (3.5" x 0.135"); or 3" x 0.131" nails	16″ o.c. 12" o.c.	90 plf 88 plf 82 plf	
16	Sole plate to joist or blocking at braced wall panels	3-16d box (31/2″ × 0.135″); or 2-16d common (3.5" x 0.162"); or 4-3" x 0.131" nails	16″ o.c.	264 lb 240 lb 328 lb	
17	Stud to sole plate, toe nail	4-8d box (21/2″ × 0.113″);or 3-16d box (31/2″ × 0.135″); or 4-8d common (2.5" x 0.131"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	—	200 lb 219 lb 248 lb 260 lb 272 lb	
18	Top or sole plate to stud, end nail	3-16d box (31/2″ × 0.135″); or 2-16d common (3.5" x 0.162"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—	198 lb 180 lb 178 lb 185 lb	
19	Top plates, laps at corners and intersections, face nail	3-10d box (3″ × 0.128″); or 2-16d common (3.5" x 0.162"); or 3-3" x 0.131" nails	—	237 lb 240 lb 246 lb	
20	1″ brace to each stud and plate, face nail	3-8d box (21/2″ × 0.113″); or 2-8d common (2.5" x 0.131"); or 2-10d box (3" x 0.128") 2 staples 13/4″	--	171 lb 140 lb 136 lb	94.5 lb 73.5 lb 90 lb
21	1″ × 6″ sheathing to each bearing, face nail	3-8d box (21/2″ × 0.113″); or 2-8d common (2.5" x 0.131"); or 2-10d box (3" x 0.128") 2 staples 13/4″	--	171 lb 140 lb 136 lb	94.5 lb 73.5 lb 90 lb
22	1″ × 8″ sheathing to each bearing, face nail	3-8d box (21/2″ × 0.113″); or 3-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128") 3 staples 13/4″	--	171 lb 140 lb 136 lb	94.5 lb 73.5 lb 90 lb
23	Wider than 1″ × 8″ sheathing to each bearing, face nail	4-8d box (21/2″ × 0.113″); or 3-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128") 4 staples 13/4"	--	228 lb 210 lb 204 lb	126 lb 110 lb 135 lb
		Floor			
24	Joist to sill or girder, toe nail	4-8d box (21/2″ × 0.113″); or 3-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	—	200 lb 186 lb 195 lb 204 lb	
25	Rim joist to top plate, toe nail (roof applications also)	8d box (21/2″ × 0.113″) 8d common (2.5" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	4" o.c. 6″ o.c.	150 plf 124 plf 130 plf 136 plf	
26	Rim joist or blocking to sill plate, toe nail	8d box (2 ½″ × 0.113″) 8d common (2.5" x 0.131"); or 10d box (3" x 0.128"); or 3" x 0.131" nails	4" o.c. 6″ o.c.	150 plf 124 plf 130 plf 136 plf	
27	1″ × 6″ subfloor or less to each joist, face nail	3-8d box (21/2″ × 0.113″); or 2-8d common (2.5" x 0.131"); or 3-10d box (3" x 0.128") 2 staples 13/4″	--	171 lb 140 lb 136 lb	94.5 lb 73.5 lb 90 lb
28	2″ subfloor to joist or girder, blind and face nail	3-16d box (31/2″ × 0.135″); or 2-16d common (3.5" x 0.162")	—	264 lb 240 lb	
29	2″ planks (plank & beam - floor & roof)	3-16d box (31/2″ × 0.135″); or 2-16d common (3.5" x 0.162")	at each bearing	264 lb 240 lb	
30	Built-up girders and beams, 2-inch lumber layers	20d common (4" x 0.192"); or 10d box (3" x 0.128"); or 3" x 0.131" nails And: 2-20d common (4" x 0.192"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails	32″ o.c. 24" o.c. Face nail at ends and each splice	108 plf 79 plf 82 plf 288 lb 237 lb 246 lb	
31	Ledger strip supporting joists	4-16d box (31/2″ × 0.135″); or	At each	352 lb	

	or rafters	3-16d common (3.5" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails	joist or rafter	360 lb 316 lb 328 lb	
Remainder or Table Unchanged					

In addition to increasing the number of smaller nails to approximate the IBC prescribed nailing for consistency, the number of nails and spacing was considered in view of loads resisted by the prescribed fastening. For example, the stud to plate connection is evaluated against wind loads as follows:

110 mph wind, exposure B (pressure is 29.1 psf per ASCE 7 and Table R301.2(2))
10 ft stud height and stud spacing of 2 ft o.c. (tributary area is 5 ft x 2 ft = 10 ft^2)
Connection load is 29.1 psf x 10 ft^2 = 291 lb
2 -16d box (3.5” x 0.135”) design value adjusted for wind = 211 lb < 291 lb (No good)
3 -16d box (3.5” x 0.135”) design value adjusted for wind = 317 lb > 291 lb (ok)

Low resistance of IRC minimum nailing relative to loads is found in connection details such as sole plate to joist and top plate to top plate, particularly where loads are based on the upper end of IRC limits (e.g. wind pressures associated with 110 mph Exposure B and 10’ stud heights). In many cases, it is observed that the increased strength of the IBC minimum fastening provides a better match to loads than the IRC fastening schedule. However, it is also noted that some minimum nailing requirements are recommended as good practice and are not strictly associated with a standard minimum load or calculation basis.

Cost Impact: The code change will increase the cost of construction.

RB272-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T #1-RB-PITTS.doc

RB273 – 13
Table R602.3(1)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER[b,c,e]	SPACING OF FASTENERS	
			Edges (inches)[i]	Intermediate supports (inches)[c,e]
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing (See Table R602.3(3) for wood structural panel *exterior* wall sheathing to wall framing)				

(Portions of Table not shown remain unchanged)

Reason: This proposal clarifies the code as to the attachment requirements for wood structural panel exterior wall sheathing. The column heading in Table R602.3(1) provides wall attachment requirements for *interior* applications only. The attachment requirements for *exterior* applications vary with the wind loading on the walls and are located in Table R602.3(3). As Table R602.3(3) is relatively new, it can be seen that the proper attachment for *exterior* wood structural panel sheathing application could be easily overlooked, as the *exterior* recommendation used to be a part of this table as well. Note also that the attachment schedule for interior wood structural panel sheathing in Table R602.3(1) is NOT conservative in that for many configurations more nails are required to resist the applied wind loads.

Note that this is not a technical change. It simply clarifies the existing intent of the code by providing proper references.

Cost Impact: The code change will not increase the cost of construction.

RB273-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T #1-RB-KEITH.doc

RB274 – 13
Table R602.3(1), Table R602.10.3(4)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a,b,c]	SPACING OF FASTENERS
14	Double top ~~plates~~ plate splice for SDCs A-D_2 with seismic braced wall line spacing < 25' - a, minimum 24-inch offset of end joints~~,~~ and face nail in lapped area on each side of the splice	8-16d (3-1/2" x 0.135")	-
	Double top plate splice SDCs D_0, D_1, or D_2; and braced wall line spacing >= 25' – a minimum 24" offset of end joints and face nail in lapped area on each side of the splice.	12-16d (3-1/2" x 0.135")	-

(Portions of Table not shown remain unchanged)

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

c. The length-to width ratio for the floor/roof *diaphragm* shall not exceed 3:1. The top plate lap splice nailing shall be ~~a minimum of 12-16d nails on each side of the splice~~ in accordance with Table R602.3(1), item 14.

(Portions of Table not shown remain unchanged)

Reason: The IRC has two separate requirements for double top plate splices. In the existing 2012 IRC Table R602.3(1), Item 14, the requirement for the double top plate splice is a minimum 24 inches offset at the splice between the top and bottom plates, attached with (8) 16d nails. This is in conflict with the requirement in Table R602.10.3(4), Footnote c. This footnote requires the use of (12) 16d nails on each side of the splice. To correct this conflict, this proposal splits Item 14 of R602.3(1) into two separate line items, to differentiate the appropriate number of nails. In addition, the language was cleaned up to indicate that the fasteners are required on each side of the splice location.

A corresponding change is proposed for Footnote c of Table R602.10.3(4) referring the user back to Table R602.3(1) for splice-plate attachment guidance.

We understand that there is a code change proposal being forwarded that will completely rewrite this table of the code. If this proposal is recommended for approval, we will work with the proponents of the rewrite to insure this is incorporated seamlessly.

Cost Impact: The code change proposal will not increase the cost of construction.

RB274-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T #2-RB-KEITH.doc

RB275 – 13
Table R602.3(1)

Proponent: Jay Crandell, ARES Consulting, representing Foam Sheathing Committee / American Chemistry Council (Jcrandell@aresconsulting.biz)

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS
17	~~Stud to~~ Top or sole plate to stud, toe nail	3-8d ($2^1/_2''$ × 0.113″) or 2-16d ($3^1/_2''$ × 0.135″)	— —

(Portions of Table not shown remain unchanged)

Reason: A similar proposal was approved for the 2015 IBC (S267-11/12) to correct an inconsistency in the conventional connection table. The code already provides a toenail connection option for the stud to bottom (sole) plate connection. This code change proposal makes requirements consistent for connection of the stud to the top plate and uses the same wording for consistency of terms. Toe nail connections provide a better uplift load path than end nails, so this option should be provided for both ends of the stud, not just at the bottom end of the stud. End nail connections are already included for both top or sole plate to stud connections in line item 18 of the existing table.

Cost Impact: This code change proposal will not increase the cost of construction.

RB275-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T-RB-CRANDELL.doc

RB276 – 13
Table R602.3 (1)

Proponent: Brian Johnson, representing self

Revise as follows:

TABLE 602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a,b,c]	SPACING OF FASTENERS
Floor			
<u>30</u>	<u>Joist to Band Joist</u>	<u>3 – 16d common (3 ½ " x 0.162")</u> <u>4 – 3" x 0.131" nails</u> <u>4 – 3" x 14 gage staples</u>	<u>face nail</u>

(Portions of Table not shown remain unchanged)

Reason: Text is taken directly from item #29 from the IBC prescriptive connection table, Table 2304.9.1; IRC does not list a nailing requirement for this item. The desire is to have IBC 2308 and IRC be essentially similar.

I believe this nailing is typically done by framers, so the addition to the code is merely to aid inspectors, and thus will not increase the cost of construction.

If the tables were split into two different tables at the separation between floor and sheathing nailing, it would not require the entire list every time a new correction is added.

Cost Impact: The code change proposal will not increase the cost of construction.

RB276-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T-RB-JOHNSON.doc

RB277 – 13

Table R602.3(1), Table R703.4

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.3(1)
FASTNER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING OF FASTENERS
32	Water-repellent siding (weighing less than 11 psf) attachment to Wood Structural Panel sheathing, either direct or over foam insulation[k]	Ring shank nail (0.148" min. dia.)	12" o.c. (per 12" of siding width)[l]
		Smooth or screw shank nail (0.148" min. dia.)	3" o.c. (per 12" of siding width)[l]
		Vinyl siding nail (0.120" min. dia.)	3" o.c. (per 12" of siding width)[l]
		#6 screw (0.138" min. dia.)	12" o.c. (per 12" of siding width)[l]
		#8 screw (0.164" min. dia.)	16" o.c. (per 12" of siding width)[l]

(Portions of table not shown remain unchanged)

k. Fastener length shall be sufficient to penetrate back side of the minimum 7/16" WSP sheathing by at least ¼".
l. Spacing of fasteners is per 12" of siding width. For other siding widths, multiply SPACING OF FASTENERS above by a factor of 12/s, where s is the siding width in inches. For example, if 8" lap siding, multiply SPACING OF FASTENERS above by 12/8 or 1.5. Fastener spacing shall never be greater than the manufacturer's minimum recommendations.

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners

(Portions of Table not shown remain unchanged)

d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions or Table R602.3(1).

Reason:
1. With the elimination of the term "nailable sheathing" in Chapter 7 last cycle, users of Table R703.4 are left without guidance on how to attach siding products to wood structural panel sheathing alone. Additionally, the trend toward the use of non-structural foam sheathing over structural sheathing has led to the development of the proposal for Item 32 above. It provides attachment recommendations for any siding products with an applied weight of less than 11 psf direct to wood structural panel sheathing or through any thicknesses of foam sheathing without having to penetrate the wall framing. This can be essential when attaching siding through thicker foam insulation panels as actually finding the framing with fasteners can be a challenge.

Footnote k requires the fastener used to penetrate the wood structural panel sheathing back side by at least ¼ inch. This will ensure that the cylindrical shank of the fastener is engaged in the wood structural panel, providing the maximum withdrawal capacity. This also provides the user with the maximum flexibility when selecting fasteners. For example, when attaching vinyl siding over 2 inches of foam sheathing into 7/16-inch wood structural panel sheathing, the fastener can be any length greater than (1/8" + 2" + 7/16" + ¼"=) 2-13/16 inches, so a 3-inch long nail should work. For a smooth shank nail, a 10d Common nail (3" x 0.148") meets both the length and diameter requirements. If 1 inch of penetration was required in the stud, a nail of (1/8" + 2" + 7/16" + 1"=) 3-9/16 inches would be required. As such, 20d box nail (4" x 0.148") or some specialty nail would be required.

Footnote l provides the methodology for adjusting the fastener spacing to accommodate lap siding greater or less than 12 inches in width. The adjustment calls for 12" to be divided by the siding width. The fastener spacing provided for in Item 32 is then multiplied by this factor.

The above proposal is based on ASCE 7-10 V_{ult}, <140 miles per hour, maximum 30 ft building height, Exposure C or less.

The table was developed based on the principle of engineering mechanics and confirmed by full-scale wind tunnel tests at the Insurance Institute for Business & Home Safety (IBHS) Research Center in Chester County, South Carolina. The wind tunnel test report is available at http://www.apawood.org/TechnicalPapers/IBHS_WindTunnelTestReport.pdf or by contacting the APA help desk at help@apawood.org.

2. Footnote d to Table R703.4 was changes to add proposed item 32 to the list of information sources available for nailing direct to wood structural panel sheathing.

Cost Impact: This code change proposal will not increase the cost of construction.

RB277-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T-RB-KEITH.doc

RB278 – 13
Table R602.3(1)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

Table R602.3(1)
FASTENING SCHEDULE ~~FOR STRUCTURAL MEMBERS~~

~~ITEM~~	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER [a, b, c]	SPACING AND LOCATION ~~OF FASTENERS~~
	Roof		
1	Blocking between ceiling joists or rafters to top plate~~, toe nail~~	3-8d (2 ½ " x 0.113")	at each end, toe nail
2	Ceiling joists to top plate~~, toe nail~~	3-8d (2 ½ " x 0.113")	per joist, toe nail
3	Ceiling joist not attached to parallel rafter laps over partitions~~, face nail~~ (see Section R802.3.1, R802.3.2, Table R802.5.1(9))	3-10d (3" x 0.128")	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.3.1, R802.3.2, Table R802.5.1(9))	Per Table R802.5.1(9)	Face nail
~~4~~5	Collar tie to rafter, ~~face nail~~ or 1 1/4" x 20 gage ridge strap to rafter	3-10d (3" x 0.128")	Face nail
~~5~~6	Rafter or roof truss to plate~~, toe nail~~	3-16d box nails (3 ½" x 0.135"); or 3-10d common nails (3" x 0.148")	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss [j]
~~6~~7	Roof rafters to ridge, valley or hip rafters: or, roof rafter to minimum 2-inch ridge beam ~~toe nail face nail~~	4-16d (3 ½ " x 0.135") 3-16d (3 ½ " x 0.135")	Toe nail End nail
	Wall		
~~7~~8	~~Built-up studs – face nail~~ Stud to stud (not at braced wall panels)	10d (3" x 0.128")	24" o.c. face nail
~~8~~9	~~Abutting studs at intersecting wall corners, face nail~~ Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d (3 ½ " x 0.135")	12" o.c. face nail
~~9~~10	~~Built-up header, two pieces with 1/2" spacer~~ Built-up header (2-inch to 2-inch header)	16d (3 1/2" × 0.135")	16" o.c. ~~along~~ each edge face nail
~~10~~	~~Continued header, two pieces~~	~~16d (3 1/2" × 0.135")~~	~~16" o.c. along each edge~~
11	Continuous header to stud~~, toe nail~~	4-8d (2 ½ " × 0.113")	Toe nail
~~12~~	~~Double studs, face nail~~	~~10d (3" × 0.128")~~	~~24" o.c.~~
~~13~~12	~~Double top plates, face nail~~ Top plate to top plate	10d (3" × 0.128")	24" o.c. face nail
~~14~~13	~~Double top plates, minimum 24-inch offset of end joints, face nail in lapped area~~ Top plate to top plate, at end joints	8-16d (3 ½ " × 0.135")	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)
~~15~~14	~~Sole plate to joist or blocking, face nail~~ Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d (3 ½ " × 0.135")	16" o.c. face nail

~~16~~15	~~Sole plate to joist or blocking at braced wall panels~~ Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	3-16d (3 1/2" × 0.135")	16" o.c. face nail
~~17~~16	Stud to ~~sole~~ bottom plate~~, toe nail~~	3-8d (2 1/2" × 0.113") or 2-16d (3 1/2" × 0.135")	Toe nail End nail
~~18~~17	Top or ~~sole~~ bottom plate to stud~~, end nail~~	2-16d (3 1/2" × 0.135")	End nail
~~19~~18	Top plates, laps at corners and intersections~~, face nail~~	2-10d (3" × 0.128")	Face nail
~~20~~19	1" brace to each stud and plate~~, face nail~~	2-8d (2 1/2" × 0.113") 2 staples 1 3/4"	Face nail --
~~21~~20	1" × 6" sheathing to each bearing~~, face nail~~	2-8d (2 1/2" × 0.113") 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail --
~~22~~	~~1" × 8" sheathing to each bearing, face nail~~	~~2-8d (2 1/2" × 0.113")~~ ~~3 staples 1 3/4"~~	~~--~~ ~~--~~
~~23~~21	~~Wider than 1" × 8" sheathing to each bearing, face nail~~ 1" x 8" and wider sheathing to each bearing	1"x 8": 2-8d (2 1/2" × 0.113") 3 staples, 1" crown, 16 ga., 1 3/4" long Wider than 1"x 8": 3-8d (2 1/2" × 0.113") 4 staples, 1" crown, 16 ga., 1 3/4" long	Face nail --
Floor			
~~24~~22	Joist to sill, top plate, or girder~~, toe nail~~	3-8d (2 1/2" × 0.113")	Toe nail
~~25~~23	~~Rim joist to top plate, toe nail (roof applications also)~~Rim joist, band joist, or blocking to sill or top plate (roof application also)	8d (2 1/2" × 0.113")	6" o.c. toe nail
~~26~~	~~Rim joist or blocking to sill plate, toe nail~~	~~8d (2 ½" × 0.113")~~	~~6" o.c.~~
~~27~~24	1" × 6" subfloor or less to each joist~~, face nail~~	2-8d (2 1/2" × 0.113") 2 staples, 1" crown, 16 ga., 1 3/4" long	Face nail
~~28~~25	2" subfloor to joist or girder~~, blind and face nail~~	2-16d (3 1/2" × 0.135")	Blind and face nail
~~29~~26	2" planks (plank & beam - floor & roof)	2-16d (3 1/2" × 0.135")	at each bearing, face nail
~~30~~27	Built-up girders and beams, 2-inch lumber layers	10d (3" × 0.128")	Nail each layer as follows: 32" o.c. at top and bottom and staggered. Two nails at ends and at each splice.
~~31~~28	Ledger strip supporting joists or rafters	3-16d (3 1/2" × 0.135")	At each joist or rafter, face nail
29	Joist to band joist or rim joist	4-10d (3" x 0.128")	End nail
30	Bridging to joist	2-10d (3" x 0.128")	Each end, toenail

ITEM	DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER[b,c,e]	SPACING OF FASTENERS	
			Edges (inches)[i]	Intermediate supports[c,e] (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing				
~~32~~31	3/8" - 1/2"	6d common (2" × 0.113") nail (subfloor wall)[j] 8d common (2 1/2" × 0.131") nail (roof)[f]	6	12[g]

~~33~~<u>32</u> ~~34~~<u>33</u>	19/32" - 1" 1 1/8" - 1 1/4"	8d common nail (2 1/2" × 0.131") 10d common (3" × 0.148") nail<u>;</u> or 8d (2 1/2" × 0.131") deformed nail	6 6	12[g] 12
Other wall sheathing [h]				
~~35~~<u>34</u>	1/2" structural cellulosic fiberboard sheathing	1 1/2" galvanized roofing nail, 7/16" ~~crown or~~ <u>head diameter, or</u> 1" crown staple 16 ga., 1 1/4" long	3	6
~~36~~<u>35</u>	25/32" structural cellulosic fiberboard sheathing	1 3/4" galvanized roofing nail, 7/16" ~~crown~~ <u>head diameter,</u> or 1" crown staple 16 ga., 1 1/2" long	3	6
~~37~~<u>36</u>	1/2" gypsum sheathing [d]	1 1/2" galvanized roofing nail; staple galvanized, 1 1/2" long; 1 1/4 screws, Type W or S	7	7
~~38~~<u>37</u>	5/8" gypsum sheathing [d]	1 3/4" galvanized roofing nail; staple galvanized, 1 5/8" long; 1 5/8" screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
~~39~~<u>38</u>	3/4" and less	6d deformed (2" × 0.120") nail<u>;</u> or 8d common (2 1/2" × 0.131") nail	6	12
~~40~~<u>39</u>	7/8" - 1"	8d common (2 1/2" × 0.131") nail<u>;</u> or 8d deformed (2 1/2" × 0.120") nail	6	12
~~41~~<u>40</u>	1 1/8" - 1 1/4"	10d common (3" × 0.148") nail<u>;</u> or 8d deformed (2 1/2" × 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 Ksi = 6.895 MPa.

a. All nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.
b. Staples are 16 gage wire and have a minimum 7/16-inch on diameter crown width.
c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
f. For regions having basic wind speed of 110 mph or greater, 8d deformed (21/2" × 0.120) nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.
g. For regions having basic wind speed of 100 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. When basic wind speed is greater than 100 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.
h. Gypsum sheathing shall conform to ASTM C 1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C 208.
i. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
j. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

This proposed change is the second part of an effort by the ICC Building Code Action Committee to create a consistent format for the conventional wood frame fastener schedules in the IBC and the IRC. The revised descriptions in this proposed change were approved in the corresponding Table 2304.9.1 of the IBC (see S265). The row descriptions and organization of the IBC table (and now proposed in this IRC table) will be substantially the same, allowing for ease of use.

Complete consistency between the actual fastening specified in the two codes was beyond the scope of the committee work. In the approved IBC table some changes were made in order to provide alternatives currently permitted in the IRC, and to establish some common nail equivalents. No substantial changes are proposed to the IRC fastening, since the existing table generally permits the substitution of box nails for common nails, and the current fastening is well established. Rather, changes have been limited to the ordering, modification, addition, or combining of the fastening descriptions for clarity and consistency.

Cost Impact: The code change proposal will not increase the cost of construction.

RB278-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)-RB-BAJNAI-BCAC.doc

RB279 – 13
Table R602.3(1)

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTRUAL MEMBERS

ITEM	DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER[b, c, e]	SPACING OF FASTENERS	
			Edges (inches)i	Intermediate supports[c, e] (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing				
32	3/8″ - ½″	6d common (2″ × 0.113″) nail (subfloor wall)[j] 8d common (2 ½″ × 0.131″) nail (roof)[f]	6	12[g]

~~f. For regions having basic wind speed of 110 mph or greater, 8d deformed (2 ½″ × 0.120) nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.~~

(Portions of Table not shown remain unchanged)

Reason: Footnote "f" is proposed for deletion to remove a conflict with wind limitations of R301.2.1.1. The remainder of Table R602.3(1) and footnotes remain unchanged by this proposal.

Currently, R301.2.1.1 states that "The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2(4)B or where the basic wind speed from Figure R301.2(4)A equals or exceeds 110 miles per hour (49 m/s)." In areas where basic wind speed equals or exceeds 110 mph, design is required in accordance with various standards which include the Wood Frame Construction Manual (WFCM). Footnote "f" could potentially cause confusion and misapplication of the prescribed nailing (6" at edges and 12" at intermediate supports) in 110 mph and greater areas. For example, nail spacing for sheathing attachment at the perimeter edge zone could be as small as 4" at edges and 4" at intermediate supports when determined in accordance WFCM Table 3.10 for 140 mph, Exposure B (equivalent to IRC 110 mph, Exposure B).

Cost Impact: The code change will not increase the cost of construction.

RB279-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(1)T #2-RB-PITTS.docE

RB280 – 13

Table R602.3(2), Chapter 44

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement* and Self

Revise as follows:

TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)

Nominal Material Thickness (inches)	Description of Fasteners and Length (inches)	Spacing of Fasteners	
		Edges (inches)	Body of panel (inches)
Floor underlayment; plywood-hardboard-particleboard[f]-fiber-cement[h]			
Fiber-cement			
¼	3d, corrosion-resistant, ring shank nails (finished flooring other than tile)	3	6
	Staple 18 ga., $^{7}/_{8}$ long, ¼ crown (finished flooring other than tile)	3	6
	1¼ long x .121 shank x .375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1¼ long, No. 8 x .375 head diameter, ribbed wafer-head screws (for tile finish)	8	8

h. Fiber-cement underlayment shall conform to ASTM C1288 or ISO 8336, Category C

Add new standard to Chapter 44 as follows:

ISO

ISO 8336 – Fibre-Cement Flat Sheets – Products Specification and Test Methods

Reason: The current table clearly limits the allowable type of permitted underlayment to wood panel-type product. The table as currently worded restrains trade by prohibiting the use of another approved type of underlayment. The inclusion of a reference to "fiber-cement" clarifies an alternative recognized product permitted in this type of Code-compliant subfloor/underlayment application (see ICC-ES ESR-1381 [reference Section 4.3], ESR-2280 [reference Sections 4.2.2.1 and 4.2.3.1 and Table 3], and ESR-2292 [reference Section 4.2]).

IBC Table 722.6.2(4) has, as a result of the Group A IBC Code Hearings, been revised to recognize fiber-cement underlayment in subfloor/underlayment combination. The addition of the new referenced ISO standard and "product category" were also approved during the Group A IBC Code Hearings. This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment by allowing fiber-cement underlayment in subfloor/underlayment combination applications.

Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1288, *Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets*. Fiber-cement producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement products for compliance with ISO 8336. The inclusion of this Standard reference in the IRC will permit manufacturers worldwide to demonstrate product compliance to IRC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade.

Cost Impact: The code change proposal will not increase the cost of construction because the proposed addition of fiber-cement underlayment to the table footnote only provides for the choice and use of a type of underlayment currently used in this type of application and permitted in ICC-ES Evaluation Service Reports.

Analysis: A review of the standard proposed for inclusion in the code, ISO 8336 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB280-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(2)-T-RB-MULDER.doc

RB281 – 13
Table R602.3(5)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association

Revise as follows:

TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS[a]

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where ~~justified by analysis~~ in compliance with exception 2 of Section R602.3.1 or designed in accordance with accepted engineering practice.

(Portions of Table not shown remain unchanged)

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The BCAC discussed what was inferred by "…where justified by analysis." meant. The conclusion was that this footnote should say that stud wall can be increased above 10 feet when the wall is compliant with exception 2 of Section R602.3.1 – in which case an engineered solution is not required.

Cost Impact: The code change proposal will not increase the cost of construction.

RB281-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3(5)-RB-BAJNAI-BCAC.doc

RB282 – 13
Table R602.3.1

Proponent: James Bela, Oregon Earthquake Awarenes

Revise as follows:

TABLE R602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO WIND SPEEDS OF 100 MPH OR LESS
IN SEISMIC DESIGN CATEGORIES A, B, C $\underline{^{b,c}}$, D_0 $\underline{^{b,c}}$, D_1 $\underline{^{b,c}}$, and D_2^{b,c}

c. Dimension Lumber grades for wood wall studs shall be minimum Construction grade lumber. Utility, standard, stud and No. 3 grade lumber of any species are not permitted.

(Portions of Table not shown remain unchanged)

Reason: (a) Wood is an orthotropic material; and it therefore exhibits "unique and independent material properties" in 3 different orthogonal directions. Trees, unfortunately, also produce naturally occurring but "strength reducing characteristics" in sawn lumber: such as knots, shakes, and splits. Therefore wall studs at the MAXIMUM ALLOWABLE LENGTH limits will have their performances, in actuality, determined by this combination or mixture of "clear wood and strength reducing characteristics."
[http://bssc.nibs.org/client/assets/files/bssc/Topic13-SeismicDesignofWoodStructuresNotes.pdf]

(b) All of the SEISMIC DESIGN CATEGORIES (C, D_0, D_1 and D_2) are at risk to experience damaging intensities of earthquake shaking; and they are not, as too often is incorrectly assumed, *guarantees* of "low - to moderate - to high" earthquake loading (comparable to other external loadings that one might anticipate and design for – such as snow load.
See IRC-14-3_FIG. R301.2(2) SEISMIC DESIGN CATEGORIES SITE CLASS D.doc for a full discussion on the systemic errors and fundamental flaws in designating SEISMIC DESIGN CATEGORIES under the USGS National Seismic Hazard Maps (as incorporated now into ASCE 7-10).

Since earthquake damage results from multiple factors: Strength of shaking, Length of shaking, Type of soil, Type of building materials, and Type of building "lateral force resisting system" – WOOD WALL STUDS should exhibit the same lumber grade.

See Buildings and earthquakes—Which stands? Which falls?
http://www.iris.edu/hq/files/programs/education_and_outreach/retm/tm_100112_haiti/BuildingsInEQs_2.pdf

(c) Finally, since the lower SEISMIC DESIGN CATEGORIES downgrade the expected earthquake effects; they permit fewer lateral force resisting elements in walls (and also allow brittle elements (gypsum sheathing) rather than ductile elements (nailed wood shear walls: alternately referred to as "braced wall panels" in the IRC).

Summary: Above 10 ft in height, where we are beginning to push the limits of a "prescriptive code," WOOD WALL STUDS should all exhibit the same engineering properties of "minimum construction grade lumber" – in order to ensure both adequate and reasonable earthquake safety performance.

STUD *LIGHT* . . . is no match for earthquakes!

See Graphic: Damage to wood stud wall – 1994 Northridge EQ

See also: IRC-14-3FIG. R301.2(2) SEISMIC DESIGN CATEGORIES SITE CLASS D.doc

Cost Impact: The code change proposal will not increase the cost of construction.

RB282-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3.1T-RB-BELA.doc

RB283 – 13
R602.3.1, Table R602.3.1

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

R602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table R602.3(5).

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls.
2. ~~Studs more than 10 feet in height which are in accordance with Table R602.3.1.~~ Where snow loads do not exceed 25 pounds per square foot, walls exposed to wind loads of 100 mph or less shall be permitted over 12 feet tall for either supporting a roof load with not more than 6' of tributary length, or for a gable end wall. The studs shall be a minimum 2x6 at 16 inches on center with a maximum height of 18 feet or 2x6 at 12 inches on center with a maximum height of 20 feet. Openings shall be permitted with jack studs supporting the header in accordance with Section R602.7 and double king studs outboard of the jacks on each side of the opening. If any portion of the two-story wall is required to be a qualified braced wall panel to achieve compliance with Section R602.10.2 for either floor, then the wall shall be designed by a registered design professional in accordance with the International Building Code.

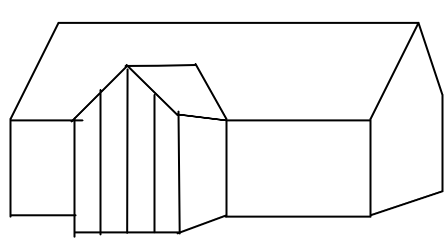
~~TABLE R602.3.1~~
~~MAXIMUM ALLOWABLE LENGTH OF WOOD STUDS EXPOSE TO WIND SPEEDS OF 100 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C, D_0, D_1, and D_2~~ ~~[b,c]~~

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

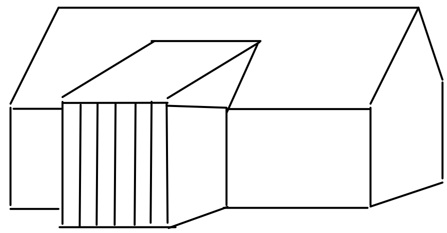
Table R602.3.1 has been the source of a lot of confusion. The footnote b is seldom read or understood. This change is submitted to:

1. Eliminate the table - the source of the confusion
2. Provide clarification as to where it can be applied (see the three options below)
3. Write in code language the requirements for when tall studs can be used.
4. To say that you cannot use these tall studs where the wall is an integral part of the wall bracing system.

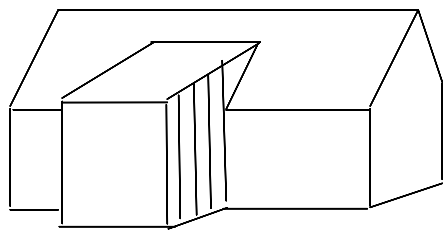
Tall studs could be used for two-story gable ended wall supporting nothing more than self weight.



Tall studs could be used for a two-story projection where the roof framing runs perpendicular to the wall so long as the overbuilt roof has a trib length of 6’ or less



Tall studs could be used for a two-story projection where the roof framing runs parallel to the wall such that it was supporting nothing more than self weight



Cost Impact: The code change proposal will not increase the cost of construction.

RB283-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3.1-RB-BAJNAI-BCAC.doc

RB284 – 13
R602.3.2

Proponent: Edward L. Keith, P.E., APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.3.2 Top plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24 inches (610 mm). Joints in plates need not occur over studs. Plates shall be not less than 2-inches (51 mm) nominal thickness and have a width at least equal to the width of the studs.

> ~~**Exception:** A single top plate may be installed in stud walls, provided the plate is adequately tied at joints, corners and intersecting walls by a minimum 3-inch by 6-inch by a 0.036-inch-thick (76 mm by 152 mm by 0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d nails on each side provided the rafters or joists are centered over the studs with a tolerance of no more than 1 inch (25 mm). The top plate may be omitted over lintels that are adequately tied to adjacent wall sections with steel plates or equivalent as previously described.~~

> **Exception:** A single top plate used as an alternative to a double top plate shall comply with the following:
>
> 1. The top plate shall be tied at corners an intersecting walls with a 3-inch by 6-inch by 0.036-inch-thick (76 mm by 152 mm by .0914 mm) galvanized steel plate or equivalent.
> 2. The steel plate tie at corners and intersecting walls shall be natiled to each wall or segment of wall with six 8d (2-1/2" x 0.113") nails on each side of the joint.
> 3. Splices in the top plate at butt joints shall be tied with a 3-inch by 12-inch by 0.036-inch-thick (76 mm by 304 mm by 0.914 mm) galvanized steel plate or equivalent.
> 4. The steel plate tie at butt joints shall be nailed to each segment of wall with twelve 8d (2-1/2" x 0.113") nails on each side of the joint.
> 5. The rafters or joists shall be centered over the studs with a tolerance of not more than 1-inch (25 mm).
> 6. Omission of the top plate is permitted over headers where the headers are adequately tied to adjacent wall sections in accordance with Items 1 and 2 for header connections at corners and intersections, and Items 3 and 4 for header connections made along a single wall line.

Reason: This is a companion item to S284-12/13 adopted in Portland in the October Final Action Hearing.

Item 14 of the 2012 IRC Table R602.3(1) establishes the minimum capacity required to insure an adequate tension splice in top plates. Aside from simply providing continuity between wall segments, the top-plate splice also acts as a tension tie (often called a collector or drag strut) to distribute the roof and floor shear loads into the bracing elements often spaced as much as 20 feet apart. Assuming spruce-pine-fir top plates the Table R602.3(1), item 14 requires a top-plate splice with eight 16d box nails on each side of the splice. In accordance with the NDS Table 11N, assuming SPF plates and a duration of load of 1.6 for lateral loads, the design capacity of the item 14 connection is (88 lb/nail x 8 nails x 1.6 dol =) 1126 lbs.

While sufficient for intersections and corners the *3-inch by 6-inch by a 0.036-inch-thick (76 mm by 152 mm by 0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d nails on each side…"* only provides about 600 lbf tension capacity (NDS Table 11P, SPF framing, box nails: 60 lbf/nail x 6 nails x 1.6 dol = 576 lbf). This is about ½ of what is requires in Table R602.3(1), item 14. As such, the splice plate requirement for in-line butt joints in single top plate systems should be twice what is currently required:

"…at least the equivalent of 3-inch by 12-inch by a 0.036-inch-thick (76 mm by 304 mm by 0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by twelve 8d (2-1.2" x 0.113") nails on each side…"

As a matter of clarification the type of nail to be used was described as only the penny-weight was specified. This is in keeping with current code style guidelines. I also specified which splice type was appropriate for headers when present. As these are neither corners nor intersections, it is clear that the butt-joint splice was the appropriate reference.

In addition, the reference to "a minimum" was deleted in favor of "at least the equivalent of" as it seemed more appropriate. "Lintels" was also changed in favor of "headers", as lintels is a term more often associated with concrete construction where headers is more commonly used in wood construction.

Cost Impact: The code change proposal will not increase the cost of construction.

RB284-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.3.2-RB-KEITH.doc

RB285 – 13
Figure R602.7.2

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

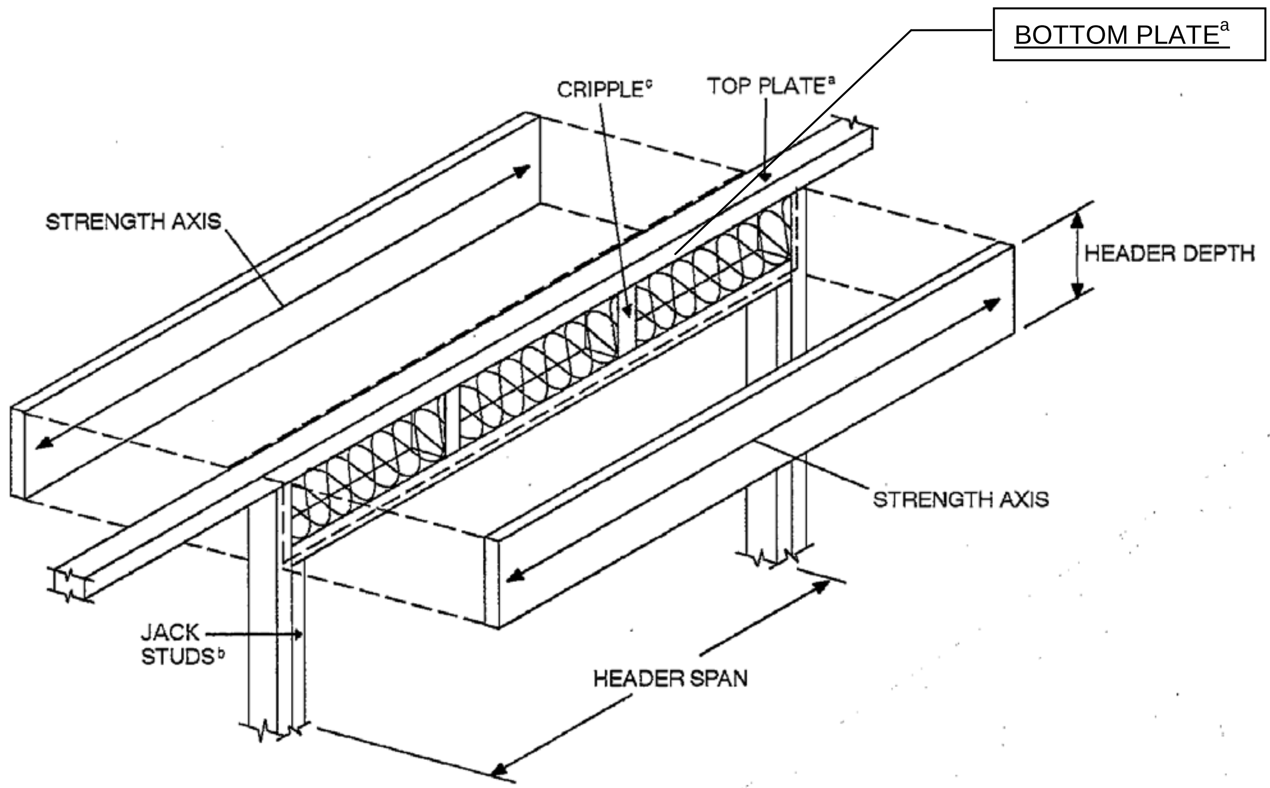


FIGURE R602.7.2
TYPICAL WOOD STRUCTURAL PANEL BOX HEADER CONSTRUCTION

a. The top <u>and bottom</u> plate<u>s</u> shall be continuous ~~over~~ <u>at</u> header location.

(Portions of Figure not shown remain unchanged)

Reason: This proposal requires that the bottom plate, as defined by part I of this proposal, be continuous at the header locations as well as the top plate. The bottom plate acts as a tension cord in a box beam and it is important that it be continuous. In fact, it is more important for gravity loads that the bottom plate to be continuous than it is for top plate continuity. This proposal requires both important elements of the box beam to be continuous so that under wind uplift loads the top chord will be continuous as well.

Cost Impact: The code change proposal will not increase the cost of construction.

RB285-13

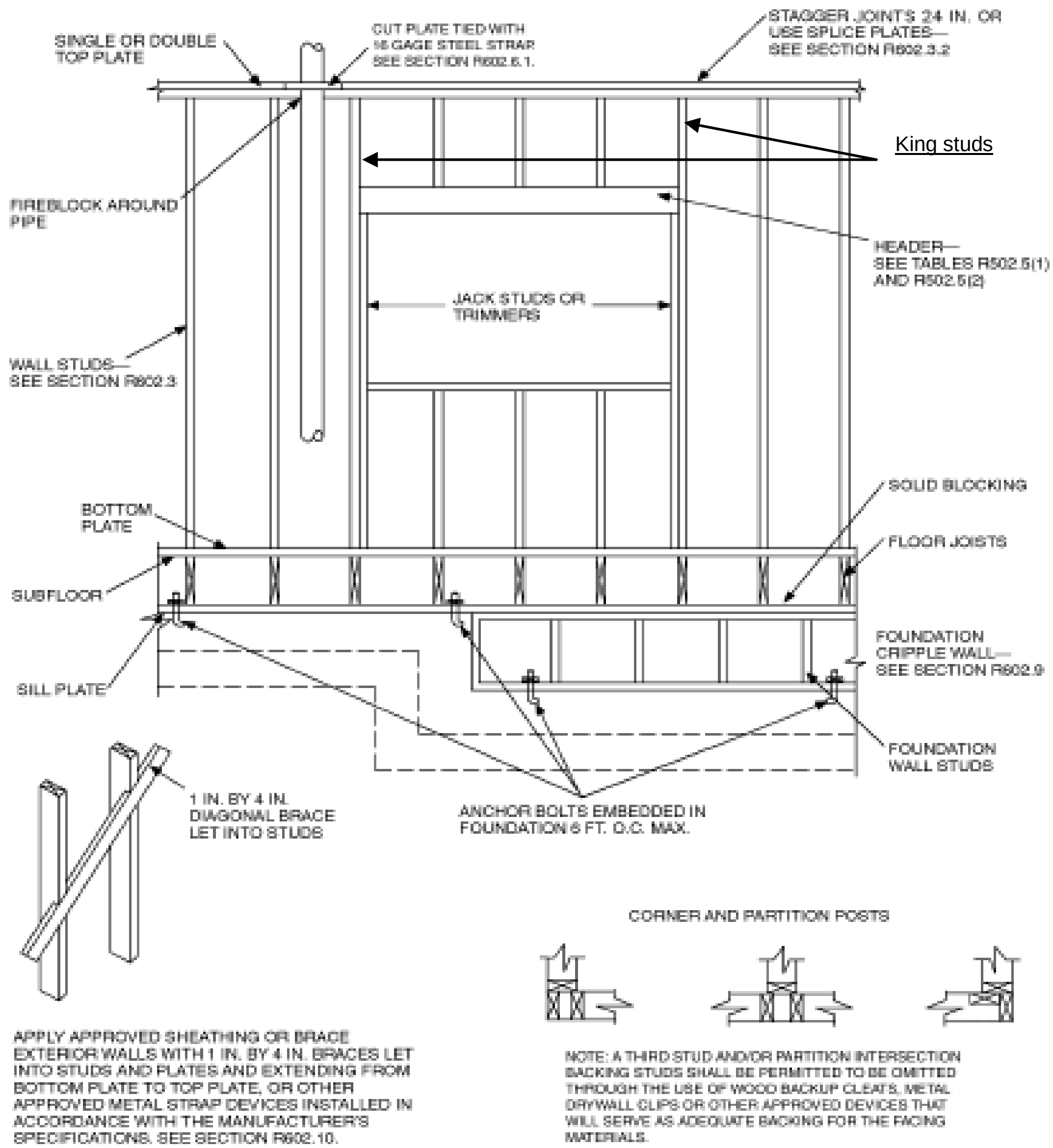
Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.7.2F-RB-KEITH.doc

RB286 – 13
Figure R602.3(2), R602.7.4 (New)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R602.3(2)
FRAMING DETAILS

602.7.4 Supports for headers. Headers shall be supported on each end with one or more jack studs in accordance with Table R502.5(1) or Table R502.5(2). A king stud shall be adjacent to the jack stud on each end of the header and nailed at each end of the header with 4-16d nails.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The code is silent about how headers should be supported to prevent header rotation. The king studs should be used to stabilize the header with nails on each end.

Cost Impact: The code change proposal will not increase the cost of construction.

RB286-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.7.4 (NEW)-RB-BAJNAI-BCAC.doc

RB287 – 13
R602.7, R602.7.1, Table R602.7.1, Table R602.7.1(2) (NEW)

Proponent: Jay Crandell, P.E., ARES Consulting, representing self (jcrandell@aresconsulting.biz)

Revise as follows:

R602.7 Headers. For header spans see Tables R502.5(1), R502.5(2), and R602.7.1(1).

R602.7.1 Single member headers. Single headers shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures R602.7.1(1) and R602.7.1(2). The number of king studs required at each end of a single member header shall comply with Table R602.7.1(2). The total number of king studs provided at both ends of a single member header need not exceed the number of layout studs displaced by the wall opening.

TABLE R602.7.1(1)
SPANS FOR MINIMUM No.2 GRADE SINGLE HEADER[a, b, c, f]

SINGLE HEADERS SUPPORTING	SIZE	WOOD SPECIES	GROUND SNOW LOAD (psf)								
			≤ 20[d]			30			50		
			Building Width (feet)[e]								
			20	28	36	20	28	36	20	28	36
Roof and ceiling	2 × 8	Spruce-Pine-Fir	4-10	4-2	3-8	4-3	3-8	3-3	3-7	3-0	2-8
		Hem-Fir or Southern Pine	5-1	4-4	3-10	4-6	3-10	3-5	3-9	3-2	2-10
		Douglas-Fir ~~or Southern Pine~~	5-3	4-6	4-0	4-7	3-11	3-6	3-10	3-3	2-11
	2 × 10	Spruce-Pine-Fir or Southern Pine	6-2	5-3	4-8	5-5	4-8	4-2	4-6	3-11	3-1
		Hem-Fir	6-6	5-6	4-11	5-8	4-11	4-4	4-9	4-1	3-7
		Douglas-Fir ~~or Southern Pine~~	6-8	5-8	5-1	5-10	5-0	4-6	4-11	4-2	3-9
	2 × 12	Spruce-Pine-Fir or Southern Pine	7-6	6-5	5-9	6-7	5-8	4-5	5-4	3-11	3-1
		Hem-Fir	7-10	6-9	6-0	6-11	5-11	5-3	5-9	4-8	3-8
		Douglas-Fir ~~or Southern Pine~~	8-1	6-11	6-2	7-2	6-1	5-5	5-11	5-1	4-6
Roof, ceiling and one center-bearing floor	2 × 8	Spruce-Pine-Fir	3-10	3-3	2-11	3-9	3-3	2-11	3-5	2-11	2-7
		Hem-Fir or Southern Pine	4-0	3-5	3-1	3-11	3-5	3-0	3-7	3-0	2-8
		Douglas-Fir ~~or Southern Pine~~	4-1	3-7	3-2	4-1	3-6	3-1	3-8	3-2	2-9
	2 × 10	Spruce-Pine-Fir or Southern Pine	4-11	4-2	3-8	4-10	4-1	3-6	4-4	3-7	2-10
		Hem-Fir	5-1	4-5	3-11	5-0	4-4	3-10	4-6	3-11	3-4
		Douglas-Fir ~~or Southern Pine~~	5-3	4-6	4-1	5-2	4-5	4-0	4-8	4-0	3-7

	2 × 12	Spruce-Pine-Fir or Southern Pine Hem-Fir Douglas-Fir ~~or Southern Pine~~	5-8 5-11 6-1	4-2 4-11 5-3	3-4 3-11 4-8	5-5 5-10 6-0	4-0 4-9 5-2	3-6 4-2 4-10	4-9 5-5 5-7	3-6 4-2 4-10	2-10 3-4 4-3
Roof, ceiling and one clear span floor	2 × 8	Spruce-Pine-Fir Hem-Fir or Southern Pine Douglas-Fir ~~or Southern Pine~~	3-5 3-7 3-8	2-11 3-1 3-2	2-7 2-9 2-10	3-4 3-6 3-7	2-11 3-0 3-1	2-7 2-8 2-9	3-3 3-5 3-6	2-10 2-11 3-0	2-6 2-7 2-9
	2 × 10	Spruce-Pine-Fir or Southern Pine Hem-Fir Douglas-Fir ~~or Southern Pine~~	4-4 4-7 4-8	3-7 3-11 4-0	2-10 3-5 3-7	4-3 4-6 4-7	3-6 3-10 4-0	2-9 3-3 3-6	4-2 4-4 4-6	3-4 3-9 3-10	2-7 3-1 3-5
	2 × 12	Spruce-Pine-Fir or Southern Pine Hem-Fir Douglas-Fir ~~or Southern Pine~~	4-11 5-6 5-8	3-7 4-3 4-11	2-10 3-5 4-4	4-9 5-6 5-7	3-6 4-2 4-10	2-9 3-3 4-3	4-6 5-4 5-6	3-4 3-11 4-8	2-7 3-1 4-2

For SI: 1 inch=25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Table is based on a maximum roof-ceiling dead load of 15 psf.

c. The header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header in lieu of the required jack stud.

d. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

e. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

f. The header shall bear on a minimum of one jack stud at each end.

TABLE R602.7.1(2)
NUMBER OF KING STUDS REQUIRED AT EACH END OF A SINGLE MEMBER HEADER[a]

STUD SIZE	OPENING WIDTH (FEET)	BASIC WIND SPEED (MPH) & EXPOSURE CONDITION																	
		85/B			90/B			100/B, 85/C			110/B, 90/C, 85/D			120/B, 100/C, 90/D			130/B, 110/C, 100/D		
		WALL HEIGHT (FEET)																	
		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
2x4	2	1	1	2	1	1	2	1	2	2	2	2	2	2	2	3	2	2	3
	3	1	2	2	1	2	2	2	2	2	2	2	3	2	3	3	2	3	4
	4	1	2	2	2	2	2	2	2	3	2	3	3	2	3	4	3	3	4
	6	2	2	3	2	2	3	2	3	3	3	3	4	3	4	5	4	4	5
	8	2	3	3	2	3	3	3	3	4	3	4	5	4	5	6	4	5	7
	10	2	3	4	3	3	4	3	4	5	4	5	6	4	6	7	5	6	8
2x6	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2
	4	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2
	6	1	1	1	1	1	2	1	2	2	1	2	2	2	2	2	2	2	3
	8	1	1	2	1	2	2	2	2	2	2	2	2	2	2	3	2	3	3
	10	1	2	2	1	2	2	2	2	2	2	2	3	2	3	3	3	3	4

For SI: 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 1.609 km/h.

a. Table is based on minimum Stud grade Spruce-Pine-Fir (South) lumber.

Reason: This proposal provides king stud requirements for wall openings spanned by single member headers to ensure structural integrity to compensate for removal of full-height layout studs over the span of the wall opening. The number of king studs required is based on wind loading only because the jack stud required with single member headers supports gravity loading (as is the case with the header requirements in Chapter 5). This proposal is in response to discussions with a concerned code official subsequent to approval of the single member header provisions last code cycle. The changes to renumbered Table R602.7.1(1) are intended to align with Southern Pine design value changes forthcoming for the respective single member header sizes.

Cost Impact: The code change proposal will increase the cost of construction.

RB287-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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R602.7, R602.7.2 (NEW), Table R602.7.2(1) (NEW), Table R602.7.2(2) (NEW), Table R602.7.3(1) (NEW), R602.7.3(2) (NEW), Figure R602.7.2 (NEW)

Proponent: Vladimir Kochkin, NAHB Research Center, Inc. (vkochkin@nahbrc.org), Jay H. Crandell, P.E., ARES Consulting (jcrandell@aresconsulting.biz)

Revise as follows:

R602.7 Headers. For header spans and number of jack studs required, see Tables R502.5(1), R502.5(2)~~,~~ ~~and~~. For single member header requirements, refer to Section R602.7.1. For rim board header requirements, refer to Section R602.7.2.

R602.7.2 Rim Board Headers. Rim board header size, material, and span shall be in accordance with Tables R602.7.2(1) and R602.7.2(2). Rim board headers shall be constructed in accordance with Figure R602.7.2 and shall be supported at each end by king studs. The number of king studs required to support each end of a rim board header shall comply with greater number from Table R602.7.3(1) and Table R602.7.3(2). For 2x6 walls with a single top plate and for 2x4 walls, the number of king studs shall not be less than two at each end of a two-ply rim board header. The total number of king studs provided at both ends of the rim board header need not exceed the number of layout studs displaced by the wall opening. Each ply of built-up king studs shall be face-nailed to the adjacent ply with 2-10d (3" x 0.128") nails at 16 inches on center. Rim board headers supporting concentrated loads, such as reactions from floor or roof girders or wall opening framing above the rim board header, shall be designed.

TABLE R602.7.2(1)
MAXIMUM ALLOWABLE SPANS FOR SINGLE-PLY RIM BOARD HEADERS[a,b]

RIM HEADERS SUPPORTING:	SIZE	WOOD SPECIES OR TYPE[d]	GROUND SNOW LOAD (psf)								
			≤ 20[e]			30			50		
			Building Width (feet)								
			20[f]	28	36	20	28	36	20	28	36
Roof, ceiling, and wall	2x10	SPF-S, SYP HF DF	5-7 5-11 6-1	4-11 5-2 5-4	4-5 4-8 4-9	5-1 5-3 5-5	4-5 4-7 4-9	3-8 4-2 4-3	4-3 4-6 4-8	3-3 3-11 4-0	2-7 3-2 3-7
	2x12	SPF-S, SYP HF DF	6-10 7-2 7-4	5-8 6-3 6-5	4-7 5-6 5-10	5-11 6-5 6-7	4-6 5-5 5-9	3-8 4-5 5-2	4-3 5-2 5-8	3-3 3-11 4-11	2-7 3-2 4-4
	1-1/8"x 9-1/2" 1-1/8"x 11-7/8"	Engr. Wood	4-5 5-6	3-10 4-10	3-6 4-4	3-11 4-11	3-5 4-4	3-1 3-11	3-4 4-2	2-11 3-8	2-7 3-2
	1-1/4"x 9-1/2" 1-1/4"x 11-7/8"	Engr. Wood	6-4 7-7	5-7 6-8	5-0 6-0	5-9 6-10	5-0 5-11	4-6 5-4	4-10 5-10	4-3 5-0	3-9 4-5
Roof, ceiling, wall, and one center-bearing floor[c]	2x10	SPF-S, SYP HF DF	4-11 5-1 5-3	4-1 4-5 4-6	3-3 3-11 4-0	4-10 5-0 5-2	3-11 4-4 4-5	3-2 3-9 4-0	4-4 4-6 4-8	3-2 3-10 4-0	2-6 3-1 3-7
	2x12	SPF-S, SYP HF DF	5-6 6-3 6-5	4-1 5-0 5-6	3-3 3-11 4-11	5-4 6-1 6-3	3-11 4-9 5-5	3-2 3-9 4-10	4-4 5-3 5-8	3-2 3-10 4-10	2-6 3-1 4-3
	1-1/8"x 9-1/2" 1-1/8"x 11-7/8"	Engr. Wood	3-10 4-9	3-3 4-1	2-11 3-8	3-9 4-8	3-3 4-0	2-11 3-7	3-5 4-3	2-11 3-7	2-6 3-1
	1-1/4"x 9-1/2" 1-1/4"x 11-7/8"	Engr. Wood	5-6 6-7	4-9 5-8	4-3 5-1	5-5 6-6	4-8 5-7	4-2 5-0	4-11 5-10	4-2 5-0	3-9 4-3
Roof, ceiling, wall and one clear span floor[c]	2x10	SPF-S, SYP HF DF	4-4 4-7 4-8	3-3 3-11 4-0	2-7 3-1 3-7	4-3 4-6 4-7	3-2 3-9 4-0	2-6 3-0 3-6	4-0 4-4 4-6	2-11 3-7 3-10	2-4 2-10 3-5
	2x12	SPF-S, SYP HF DF	4-5 5-4 5-8	3-3 3-11 4-11	2-7 3-1 4-4	4-3 5-2 5-7	3-2 3-9 4-10	2-6 3-0 4-2	4-0 4-10 5-6	2-11 3-7 4-8	2-4 2-10 3-11
	1-1/8"x 9-1/2" 1-1/8"x 11-7/8"	Engr. Wood	3-5 4-3	2-11 3-8	2-7 3-2	3-4 4-2	2-11 3-7	2-7 3-1	3-3 4-1	2-10 3-6	2-6 2-11
	1-1/4"x 9-1/2" 1-1/4"x 11-7/8"	Engr. Wood	4-11 5-10	4-3 5-0	3-9 4-4	4-10 5-9	4-2 4-11	3-8 4-2	4-9 5-7	4-1 4-10	3-7 3-11

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Table is based on a maximum roof-ceiling dead load of 15 psf, floor dead load of 10 psf, and floor live load of 40 psf.

c. Floor joists framing into rim header shall be attached to the rim header using joist hangers sized to support the joist bearing load or an approved design.

d. Solid sawn wood rim members shall be minimum No. 2 grade. Engineered wood rim members shall meet or exceed the following material design properties and comply with applicable usage limitations in accordance with the manufacturer's approved data:
1-1/8" members: F_b=600 psi, F_v=270 psi, E=550,000 psi, $F_{c,perp}$=550 psi
1-1/4" members: F_b=1,130 psi, F_v=355 psi, E=660,750 psi, $F_{c,perp}$=680 psi

e. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

f. To determine the allowable span for rim board headers parallel to floor joists and supporting non-load bearing walls above, use table column for 20 psf ground snow load and 20 ft building width with "roof, ceiling, and wall" support condition.

TABLE R602.7.2(2)
MAXIMUM ALLOWABLE SPANS FOR TWO-PLY RIM BOARD HEADERS[a,b]

RIM HEADERS SUPPORTING:	SIZE	WOOD SPECIES OR TYPE[d]	GROUND SNOW LOAD (psf)								
			≤ 20[e]			30			50		
			Building Width (feet)								
			20[f]	28	36	20	28	36	20	28	36
Roof, ceiling, and wall	2-2x10	see Table R502.5(1)									
	2-2x12	see Table R502.5(1)									
	(2)1-1/8"x 9-1/2" (2)1-1/8"x 11-7/8"	Engr. Wood	6-3 7-9	5-5 6-10	4-11 6-2	5-7 7-0	4-11 6-1	4-5 5-6	4-9 5-11	4-2 5-2	3-8 4-7
	(2)1-1/4"x 9-	Engr.	8-4	7-8	7-1	7-9	7-1	6-4	6-11	6-0	5-4

	1/2” (2)1-1/4”x 11-7/8”	Wood	10-5	9-5	8-6	9-8	8-5	7-7	8-2	7-1	6-5
Roof, ceiling, wall, and one center-bearing floor[c]	2-2x10	see Table R502.5(1)									
	2-2x12	see Table R502.5(1)									
	(2)1-1/8”x 9-1/2” (2)1-1/8”x 11-7/8”	Engr. Wood	5-5 6-9	4-8 5-10	4-2 5-2	5-4 6-8	4-7 5-8	4-1 5-1	4-9 6-0	4-1 5-1	3-8 4-7
	(2)1-1/4”x 9-1/2” (2)1-1/4”x 11-7/8”	Engr. Wood	7-7 9-4	6-9 8-0	6-0 7-2	7-6 9-2	6-7 7-10	5-11 7-0	6-11 8-3	5-11 7-1	5-3 6-3
Roof, ceiling, wall and one clear span floor[c]	2-2x10	see Table R502.5(1)									
	2-2x12	see Table R502.5(1)									
	(2)1-1/8”x 9-1/2” (2)1-1/8”x 11-7/8”	Engr. Wood	4-10 6-0	4-2 5-9	3-8 4-7	4-9 5-11	4-1 5-1	3-7 4-6	4-7 5-9	3-11 4-11	3-6 4-4
	(2)1-1/4”x 9-1/2” (2)1-1/4”x 11-7/8”	Engr. Wood	7-0 8-4	6-0 7-1	5-4 6-4	6-10 8-2	5-11 7-0	5-3 6-3	6-8 7-11	5-9 6-10	5-1 5-11

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Table is based on a maximum roof-ceiling dead load of 15 psf, floor dead load of 10 psf, and floor live load of 40 psf.

c. Floor joists framing into rim header shall be attached to the rim header using joist hangers sized to support the joist bearing load or an approved design.

d. For solid sawn wood, refer to Table R502.5(1). Engineered wood rim members shall meet or exceed the following material design properties and comply with applicable usage limitations in accordance with the manufacturer’s approved data and usage limitations:
1-1/8” members: F_b=600 psi, F_v=270 psi, E=550,000 psi, $F_{c,perp}$=550 psi
1-1/4” members: F_b=1,130 psi, F_v=355 psi, E=660,750 psi, $F_{c,perp}$=680 psi

e. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

f. To determine the allowable span for rim board headers parallel to floor joists and supporting non-load bearing walls above, use table column for 20 psf ground snow load and 20 ft building width with “roof, ceiling, and wall” support condition.

TABLE R602.7.3(1)
NUMBER OF KING STUDS REQUIRED FOR GRAVITY LOAD RESISTANCE[a]

KING POST SUPPORTING:	OPENING WIDTH (FEET)	2x4 FRAMING									2x6 FRAMING								
		GROUND SNOW LOAD (PSF)									GROUND SNOW LOAD (PSF)								
		≤ 20[b]			30			50			≤ 20			30			50		
		BUILDING WIDTH (FEET)									BUILDING WIDTH (FEET)								
		20[c]	28	36	20	28	36	20	28	36	20	28	36	20	28	36	20	28	36
Roof, ceiling, and wall	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	3	1	1	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1
	4	1	1	2	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1
	6	2	2	2	2	2	3	2	3	3	1	1	1	1	1	1	1	2	2
	8	2	2	3	2	3	3	3	4	5	1	1	2	1	2	2	2	2	2
	10	2	3	3	3	3	4	4	5	6	1	2	2	1	2	2	2	2	3
	12	3	3	4	3	4	5	4	5	6	1	2	2	2	2	2	2	3	3
Roof, ceiling, wall, and one center-bearing floor[c]	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	3	1	1	2	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1
	4	1	2	2	1	2	2	2	2	3	1	1	1	1	1	1	1	1	1
	6	2	2	3	2	2	3	2	3	4	1	1	2	1	1	2	1	2	2
	8	2	3	4	2	3	4	3	4	5	1	2	2	1	2	2	2	2	2
	10	3	4	4	3	4	5	3	5	6	2	2	2	2	2	2	2	2	3
	12	3	4	5	3	4	5	4	5	7	2	2	3	2	2	3	2	3	3
Roof, ceiling, wall and one clear span floor[c]	2	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1
	3	1	2	2	1	2	2	1	2	2	1	1	1	1	1	1	1	1	1
	4	2	2	3	2	2	3	2	2	3	1	1	1	1	1	1	1	1	2
	6	2	3	4	2	3	4	2	3	4	1	2	2	1	2	2	1	2	2
	8	3	4	5	3	4	5	3	4	5	2	2	2	2	2	2	2	2	3
	10	3	5	6	4	5	6	4	5	6	2	2	3	2	2	3	2	3	3
	12	4	5	7	4	5	7	4	6	7	2	3	3	2	3	3	2	3	4

For SI: 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Table is based on minimum Stud grade Spruce-Pine-Fir (South) lumber, a maximum roof-ceiling dead load of 15 psf, floor dead load of 10 psf, and floor live load of 40 psf.

b. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

c. To determine the required number of king studs for rim board headers parallel to floor joists and supporting non-load bearing walls above, use table column for 20 psf ground snow load and 20 ft building width with “roof, ceiling, and wall” support condition.

TABLE R602.7.3(2)
NUMBER OF KING STUDS REQUIRED FOR WIND LOAD RESISTANCE[a]

STUD SIZE	OPENING WIDTH (FEET)	BASIC WIND SPEED (MPH) & EXPOSURE CONDITION																	
		85/B			90/B			100/B, 85/C			110/B, 90/C, 85/D			120/B, 100/C, 90/D			130/B, 110/C, 100/D		
		WALL HEIGHT (FEET)																	
		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
2x4	2	1	1	2	1	1	2	1	2	2	2	2	2	2	2	3	2	2	3
	3	1	2	2	1	2	2	2	2	2	2	2	3	2	3	3	2	3	4
	4	1	2	2	2	2	2	2	2	3	2	3	3	2	3	4	3	3	4
	6	2	2	3	2	2	3	2	3	3	3	3	4	3	4	5	4	4	5
	8	2	3	3	2	3	3	3	3	4	3	4	5	4	5	6	4	5	7
	10	2	3	4	3	3	4	3	4	5	4	5	6	4	6	7	5	6	8
	12	3	3	4	3	4	5	4	5	6	4	5	7	5	6	7	6	7	8
2x6	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2
	4	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2
	6	1	1	1	1	1	2	1	2	2	1	2	2	2	2	2	2	2	3

	8	1	1	2	1	2	2	2	2	2	2	2	2	2	2	3	2	3	3
	10	1	2	2	1	2	2	2	2	2	2	2	3	2	3	3	3	3	4
	12	2	2	2	2	2	2	2	2	3	2	3	3	2	3	4	3	4	4

For SI: 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 1.609 km/h.

a. Table is based on minimum Stud grade Spruce-Pine-Fir (South) lumber.

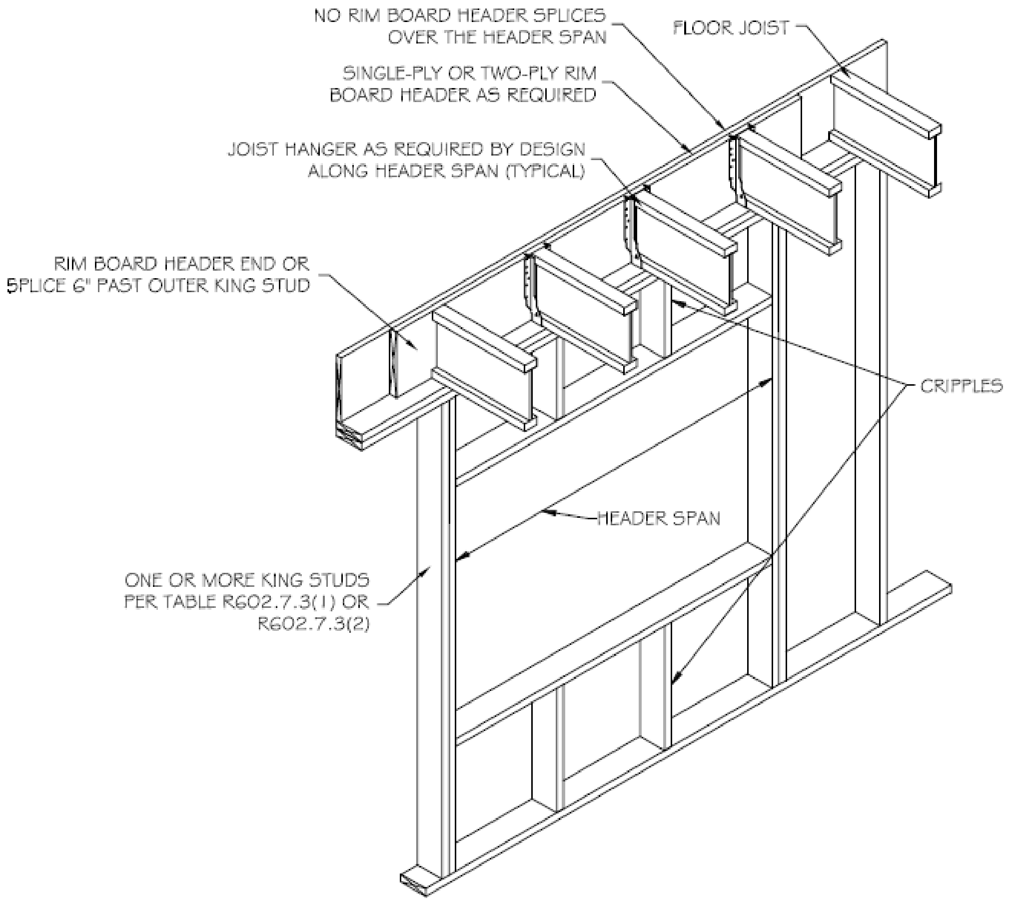

FIGURE R602.7.2
RIM BOARD HEADER CONSTRUCTION

Reason: This proposal adds a rim board header option to promote more resource and energy efficient wall framing. The analysis of rim board headers for this proposal is based on the same methodology applied for the existing IRC provisions for single headers and is consistent with header analysis as applied in the Wood Frame Construction Manual (WFCM). Both solid sawn and engineered wood members are included. King stud requirements are added to ensure adequate support of rim board headers and out-of-plane wind load resistance as this type of header construction uses only king studs which serve as jamb or trimmer studs for the wall opening below.

Cost Impact: The code change proposal will not increase the cost of construction.

RB288-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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R202, R602.10.1, R602.10.1.1, Figure R602.10.1.1, R602.10.1.2, R602.10.1.3, Table R602.10.1.3, R602.10.1.4

Proponent: Brian Foley, P.E., Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov)

Revise as follows:

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing, braced wall lines shall be centerlines of 8 foot (2438 mm) wide bands containing wall bracing as shown in Figure R602.10.1. Braced wall lines shall be designated in the building plan, on each story level and in each plan direction at a spacing in accordance with Table R601.10.1. Braced wall lines shall be placed such that all exterior walls are within the band of a braced wall line and all interior walls containing bracing are within the band of a braced wall line.~~required in each story level of a building, braced wall lines shall be designated as straight lines on the building plan placed in accordance with this section.~~

R602.10.1.1 Length of a braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with ~~a perpendicular~~ another braced wall line, an angled braced wall line as permitted in Section R602.10.1.2 or an exterior wall as shown in Figure R602.10.1.1.Where design elements of the building plan or elevation create conditions where a braced wall line cannot intersect with another, the end shall extend to the farthest end of the building.

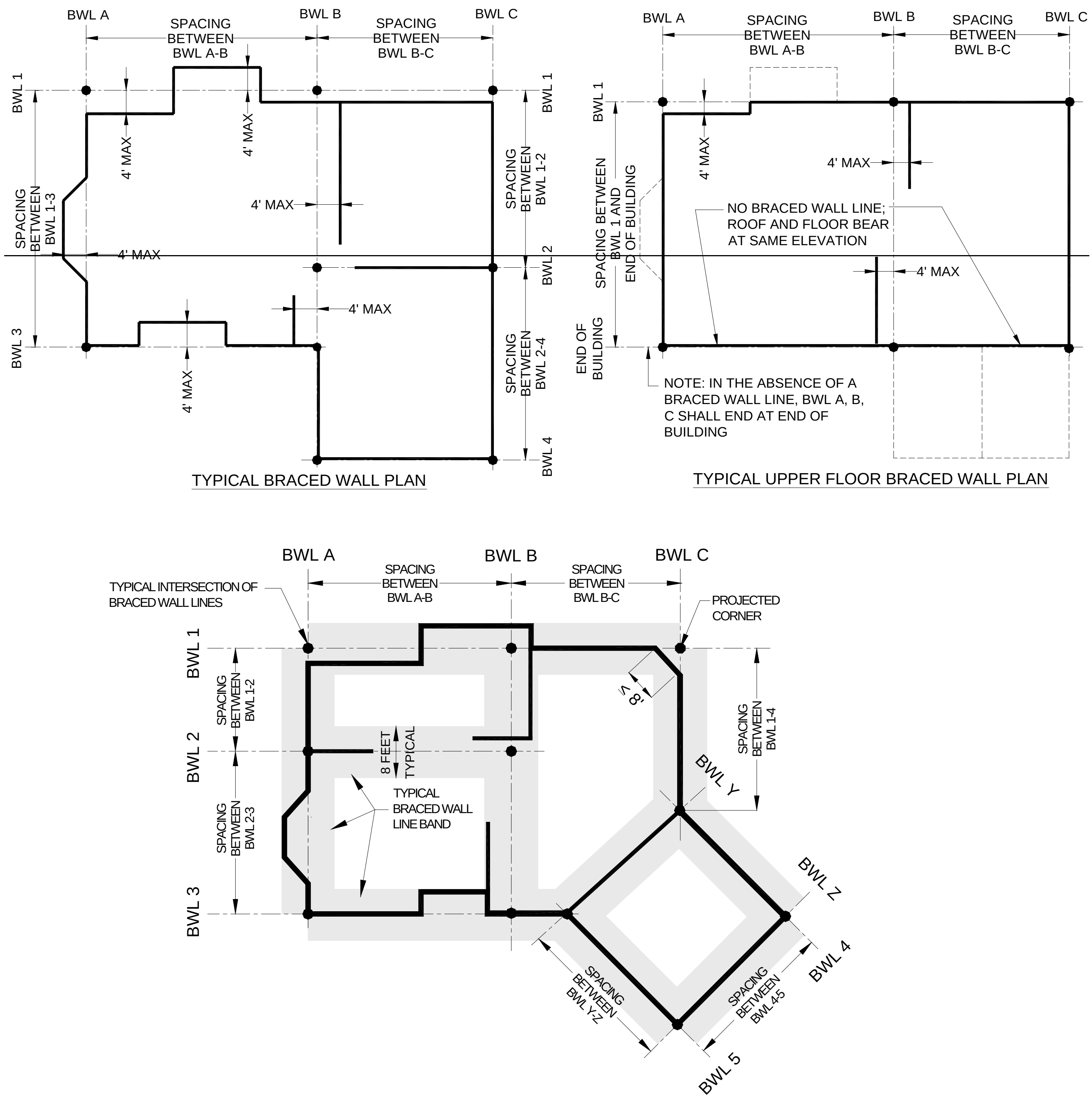


FIGURE R602.10.1~~.1~~
PLACEMENT OF BRACED WALL LINES

~~**R602.10.1.2 Offsets along a braced wall line.** All exterior walls parallel to a braced wall line shall be permitted to offset up to 4 feet (1219 mm) from the designated braced wall line location as shown Figure R602.10.1.1. Interior walls used as bracing shall be permitted to offset up to 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1.~~

~~**R602.10.1.3 Spacing of braced wall lines.** There shall be a minimum of two braced wall lines in both the longitudinal and transverse direction as shown in Figure R602.10.1.1. Intermediate braced wall lines through the interior of the building shall be permitted. The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3.~~

TABLE R602.10.1~~.3~~
BRACED WALL LINE SPACING

(Portions of Table not shown remain unchanged)

~~R602.10.1.4~~ R602.10.1.2 Angled walls. Any portion of a wall ~~along~~ within the band of a braced wall line shall be permitted to angle out of plane for a maximum diagonal length of 8 feet (2438 mm). Where the angled wall occurs at a corner, the length of the braced wall line shall be measured from the projected corner as shown in Figure R602.10.1~~.4~~. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered a separate braced wall line and shall be braced in accordance with Section R602.10.1.

Revise definition as follows:

BRACED WALL LINE. ~~A straight line~~ The centerline of an 8 foot (2438 mm) wide band through the building plan that represents the location of the lateral resistance provided by the wall bracing.

Reason: Braced wall lines have long been a confusing concept. During over 50 sessions of training on the 2009 and 2012 IRC wall bracing provisions, it is quite clear that users are not easily grasping braced wall lines. Fortunately, training clarifies the concept; however, for the user that is unable to attend training it is much more difficult when he or she is forced to understand braced wall line concepts by merely reading the code provisions.

With no technical modifications, this code change proposal introduces a braced wall line's “band” of bracing. Rather than describe that walls may offset 4 feet on either side of a braced wall line, the proposed concept simply explains that any wall within a braced wall line's 8 foot wide “band” can contribute to the its requirements. Since introducing the “band” to training sessions, students have been able to understand braced wall lines and the braced wall panel contributions quickly and easily.

This is a concept that is similar to the "braced wall bands" from the National Building Code of Canada.
The remainder of the proposed language simply clarifies the provisions based on user feedback and questions raised during training.

The new figure merges the concepts from the two existing figures and incorporates the braced wall line “band.”

Cost Impact: The code change proposal will not increase the cost of construction.

RB289-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.1-RB-FOLEY.doc

RB290 – 13
R602.10.2.2.1

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be located at each end of a braced wall line.

Exception: Braced wall panels constructed of Methods WSP or BV-WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with one of the following:

1. A minimum 24-inch wide (610 mm) panel for Methods WSP, CS-WSP, CS-G, and CS-PF~~, and 32-inch wide (813 mm) panel for Method CS-~~SFB is applied to each side of the building corner as shown in Condition 4 of Figure R602.10.7.

2. The end of each braced wall panel closest to the end of the braced wall line shall have a 1,800 lb (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in Condition 5 of Figure R602.10.7.

3. For Method BV-WSP, hold-down devices shall be provided in accordance with Table R602.10.6.5 at the ends of each braced wall panel.

4. <u>Each end of the braced wall line without a return corner has a Method ABW or PFH located at the corner of the braced wall line. If Method PFH is used the leg of the portal shall be located directly adjacent to the corner of the wall line.</u>

Reason: The change to Exception 1 removes the reference to Method CS-SFB as a method for meeting the alternative corner attachment requirement for SDCs D_0, D_1, and D_2 because IRC Table R602.10.4, Footnote d clearly does not permit the use of CS-SFB in SDCs D_0, D_1, and D_2. This proposal eliminates conflicting language in the IRC and corrects an error in the code.

The addition of Exception 4 provides for the addition of Methods ABW or PFH to a list of methods to provide alternative corner attachment requirements for SDCs D_0, D_1, and D_2. Both Methods ABW and PFH are anchored to the structure below with mechanical hold downs equal to or in excess of the 1,800 lbf required in Exception 2. Method ABW has a *minimum* hold down requirement of 1,800 lbf and the Method PFH has a hold down requirement of 4,200 lbf. (Note that there is a code change proposal for this cycle that will reduce this hold down requirement to 3,500 lbf. If the 3,500 lbf proposal is accepted the above code change proposed above will still be valid.)

Cost Impact: The code change proposal will not increase the cost of construction.

RB290-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.2.2.1 #2-RB-KEITH.doc

RB291 – 13
R602.10.2.2.1

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2. Braced wall panels shall be located at each end of a braced wall line.

Exception: Braced wall panels constructed of Methods WSP or BV-WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with one of the following:

1. A minimum 24-inch wide (610 mm) panel for Methods WSP, CS-WSP, CS-G, and CS-PF, and 32-inch wide (813 mm) panel for Method CS-SFB is applied to each side of the building corner as shown in Condition 4 of Figure R602.10.7.

2. The end of each braced wall panel closest to the end of the braced wall line shall have a 1,800 lb (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in Condition 5 of Figure R602.10.7. For Method BV-WSP, hold-down devices shall be provided in accordance with Table R602.10.6.5 at the ends of each braced wall panel.

~~3. For Method BV-WSP, hold-down devices shall be provided in accordance with Table R602.10.6.5 at the ends of each braced wall panel.~~

Reason: Method BV-WSP was removed in Exception 1. As Method BV-WSP requires hold downs at each end of each braced wall panel, it can be used to anchor a braced wall line but it would not be required on each side of the building corner. This method of anchorage would better fit in Exception 2.

The information in Exception 3 was moved up to be a part of Exception 2. Exception 2 requires the use of a 1,800 lbf hold down at the corners of braced wall lines in lieu of a braced wall panels at each end of the braced wall line. Method BV-WSP per IRC Table R602.10.6.5 uses a hold down of 1,900 lbf or greater, exceeding the 1,800 lbf hold down requirement for other bracing methods. Placing the BV-WSP in Exception 2 makes it clear that the 1,800 lbf hold down is not in addition to the required hold downs for BV-WSP in Table R602.10.6.5.

Cost Impact: The code change proposal will not increase the cost of construction.

RB291-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.2.2.1 #1-RB-KEITH.doc

RB292 – 13
R602.10.2.2.1

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D0, D1 and D2. Braced wall panels shall be located at each end of a braced wall line.

> **Exception:** Braced wall panels constructed of Methods WSP or BV-WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with one of the following.
>
> 1. A minimum 24-inch-wide (610 mm) panel for Methods WSP, CS-WSP, CS-G, and CS-PF, and 32-inch-wide (813 mm) panel for Method CS-SFB is applied to each side of the building corner as shown in Condition 4 of Figure R602.10.7.
> 2. The end of each braced wall panel closest to the end of the braced wall line shall have an 1,800 lb (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in Condition 5 of Figure R602.10.7.
> 3. ~~For Method BV-WSP, hold-down devices shall be provided in accordance with Table R602.10.6.5 at the ends of each braced wall panel.~~

Reason: The purpose of this code change is to correct a conflict in the code provisions for Method BV-WSP that was brought to our attention by ICC staff. The lowest capacity hold-down specified in Table R602.10.6.5 is 1900 pounds. Therefore, the only case of a Method BV-WSP panel that doesn't automatically qualify for Exception #2 is a single-story house in SDC D0 with veneer up to the tip of a gable. As such, Exception #3 is generally redundant and can be deleted. For that single-story case, either Exception #1 or Exception #2 would apply.

Cost Impact: The code change proposal will not increase the cost of construction.

RB292-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

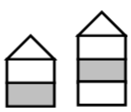
R602.10.2.2.1-RB-EHRLICH.doc

RB293 – 13
Table R602.10.3(1)

Proponent: Brian Foley, P.E., Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov)

Revise as follows:

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30 FT MEAN ROOF HEIGHT • 10 FT EAVE TO RIDGE HEIGHT • 10 FT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing[c] (feet)**	**Method LIB[b]**	**Method GB**	**Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFG, CS-SFB[~~e~~d]**	**Methods CS-WSP, CS-G, CS-PF**
< 110[~~e~~d]		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0
		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

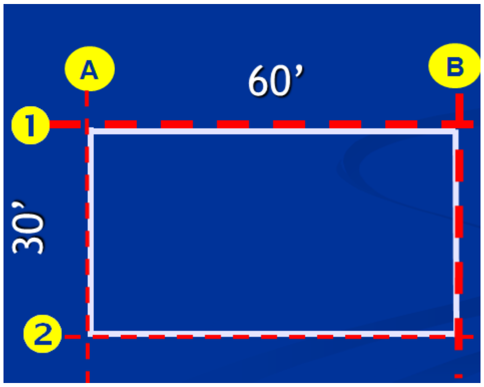
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.
a. Linear interpolation shall be permitted.
b. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).
c. Where a braced wall line has parallel braced wall lines on one or both sides of differing dimensions, the average dimension shall be permitted to be used for braced wall line spacing.
~~e~~d. Method CS-SFB does not apply where the wind speed is greater than 100 mph.

(Portions of Table not shown remain unchanged)

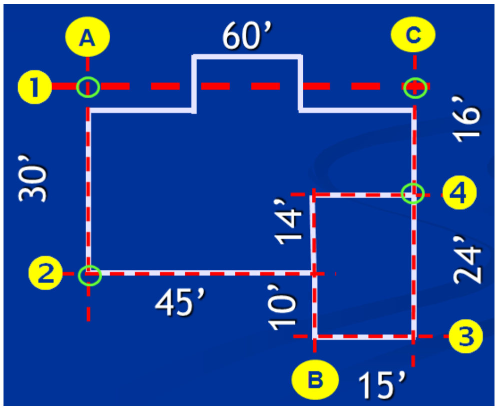
Reason: Table R602.10.3 was developed with the concept of braced wall lines running through the entire building in each plan direction much like the configuration of a simple colonial or ranch house. However, once this table was applied to the reality of today's house designs it was quickly determined that this concept was the exception rather than the rule. The code is silent on what to do when a braced wall line spacing is different on each side Do you use the greater value? If so, you will be required to provide more bracing than would be necessary. Do you use the lessor value? If so you will be providing less bracing than needed.

To formulate the correct approach, members of the former ICC Ad Hoc Committee on Wall Bracing conferred and blessed the approach provided in this proposal. As footnote c describes, you would use an average spacing much like a designer would use a tributary area when calculating the design of a beam or girder.

Consider the BWL layout of this common ranch below. It's a simple exercise to identify the braced wall line spacing of BWL 1…30 feet. Likewise, the braced wall line spacing of BWL A would be 60 feet. In this case, there is only one adjacent parallel BWL.



However, consider the BWL layout of a more complex house below. The next parallel braced wall line to BWL A is BWL C 60 feet away at the top end and BWL B 45 feet away at the bottom end. To find the value to use in Table R602.10.3(1), you would use the average between 60 and 45 which would equal 52.5 feet. If you were to analyze BWL 4, at the left end, the next parallel braced wall lines would be BWL 1 to the top and BWL 2 to the bottom. At the right end the next parallel braced wall line to the top is BWL 1 and BWL 3 to the bottom. To find the average spacing, you would use 16, 14, 16 and 24 feet for an average spacing of 17.5 feet.



The other changes to this table include adding the braced wall panel methods that were unintentionally omitted during the last code change cycle. It was always the intent of Table R602.10.3(1) to include all of the intermittent methods (except LIB and GB) in the same column.

Cost Impact: The code change proposal will not increase the cost of construction. In cases where an AHJ forced users to base their braced wall line spacing on the largest of all spacings, this will have a positive cost impact considering the proposal, if approved, would require less bracing and thus a lower cost impact.

RB293-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.3(1)T-RB-FOLEY.doc

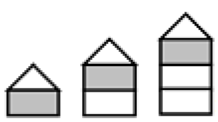
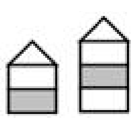
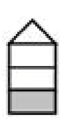
RB294 – 13
Table R602.10.3(1)

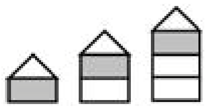
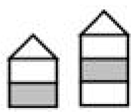
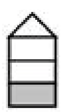
Proponent: Louis Wagner, Executive Director, North American Fiberboard Association (lwagner@fiberboard.org)

Revise as follows:

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT EAVE-TO-RIDGE HEIGHT • 10 FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Basic Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Method LIB[b]	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB[c]	Methods CS-WSP, CS-G, CS-PF
≤ 85		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.0	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.0	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.0	15.5
		50	NP	39.0	22.5	19.0
		60	NP	46.5	26.5	22.5
≤ 90		10	3.5	3.5	2.0	2.0
		20	7.0	7.0	4.0	3.5
		30	9.5	9.5	5.5	5.0
		40	12.5	12.5	7.5	6.0

• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT EAVE-TO-RIDGE HEIGHT • 10 FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
		50	15.5	15.5	9.0	7.5
		60	18.5	18.5	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	13.0	13.0	7.5	6.5
		30	18.5	18.5	10.5	9.0
		40	24.0	24.0	14.0	12.0
		50	29.5	29.5	17.0	14.5
		60	35.0	35.0	20.0	17.0
		10	NP	10.5	6.0	5.0
		20	NP	19.0	11.0	9.5
		30	NP	27.5	15.5	13.5
		40	NP	35.5	20.5	17.5
		50	NP	44.0	25.0	21.5
		60	NP	52.0	30.0	25.5
≤ 100		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.0	19.0	11.0	9.5
		60	22.5	22.5	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.0	8.0
		30	23.0	23.0	13.0	11.0
		40	29.5	29.5	17.0	14.5
		50	36.5	36.5	21.0	18.0
		60	43.5	43.5	25.0	21.0
		10	NP	12.5	7.5	6.0
		20	NP	23.5	13.5	11.5
		30	NP	34.0	19.5	16.5
		40	NP	44.0	25.0	21.5
		50	NP	54.0	31.0	26.5

• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT EAVE-TO-RIDGE HEIGHT • 10 FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
		60	NP	64.0	36.5	31.0
< 110[c]		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0
		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to at least one side with nails or screws in accordance withTable R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

~~c. Method CS-SFB does not apply where the wind speed is greater than 100 mph.~~

Reason: There is a logical inconsistency in prohibiting CS-SFB when SFB which uses less bracing material is permitted. CS-SFB has already been penalized by ranking it lower than other continuous sheathings.

Related code changes have been submitted for TABLE R602.10.3(1) Footnote c, TABLE R602.10.3(3) Footnote d and TABLE R602.10.4 Footnote d. All three should be heard together.

Cost Impact: The code change proposal will not increase the cost of construction.

RB294-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.3(1)T-RB-WAGNER.doc

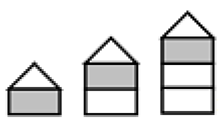
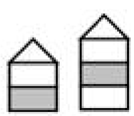
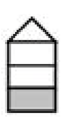
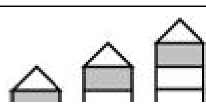
RB295 – 13
Table R602.10.3(1), Table R602.10.3(3), Table R602.10.4

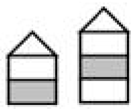
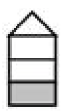
Proponent: Dennis Pitts, American Wood Council, representing American Wood Council (dpitts@awc.org)

Revise as follows:

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30 FOOT MEAN ROOF HEIGHT • 10 FOOT EAVE-TO-RIDGE HEIGHT • 10 FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]			
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing** (feet)	**Method LIB[b]**	**Method GB**	**Methods** DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB[e]	**Methods** CS-WSP, CS-G, CS-PF
≤ 85		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.0	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.0	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.0	15.5
		50	NP	39.0	22.5	19.0
		60	NP	46.5	26.5	22.5
≤ 90		10	3.5	3.5	2.0	2.0
		20	7.0	7.0	4.0	3.5
		30	9.5	9.5	5.5	5.0
		40	12.5	12.5	7.5	6.0

		50	15.5	15.5	9.0	7.5
		60	18.5	18.5	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	13.0	13.0	7.5	6.5
		30	18.5	18.5	10.5	9.0
		40	24.0	24.0	14.0	12.0
		50	29.5	29.5	17.0	14.5
		60	35.0	35.0	20.0	17.0
		10	NP	10.5	6.0	5.0
		20	NP	19.0	11.0	9.5
		30	NP	27.5	15.5	13.5
		40	NP	35.5	20.5	17.5
		50	NP	44.0	25.0	21.5
		60	NP	52.0	30.0	25.5
≤ 100		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.0	19.0	11.0	9.5
		60	22.5	22.5	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.0	8.0
		30	23.0	23.0	13.0	11.0
		40	29.5	29.5	17.0	14.5
		50	36.5	36.5	21.0	18.0
		60	43.5	43.5	25.0	21.0
		10	NP	12.5	7.5	6.0
		20	NP	23.5	13.5	11.5
		30	NP	34.0	19.5	16.5
		40	NP	44.0	25.0	21.5
		50	NP	54.0	31.0	26.5
		60	NP	64.0	36.5	31.0
< 110[e]		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0

		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

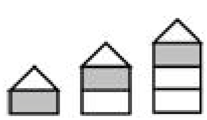
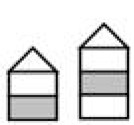
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

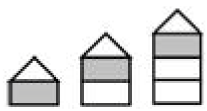
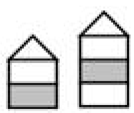
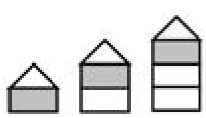
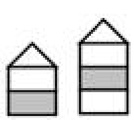
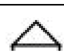
a. Linear interpolation shall be permitted.

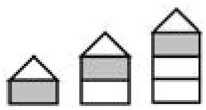
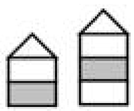
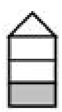
b. Method LIB shall have gypsum board fastened to at least one side with nails or screws in accordance withTable R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

~~c. Method CS-SFB does not apply where the wind speed is greater than 100 mph.~~

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• **SOIL CLASS D**[b] • **WALL HEIGHT = 10 FEET** • **10 PSF FLOOR DEAD LOAD** • **15 PSF ROOF/CEILING DEAD LOAD** • **BRACED WALL LINE SPACING ≤ 25 FEET**			**MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE**[a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)**	**Method LIB**[c]	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB**[d]	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7

		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	2.8	2.8	1.8	1.6
		20	NP	5.5	5.5	3.6	3.1
		30	NP	8.3	8.3	5.4	4.6
		40	NP	11.0	11.0	7.2	6.1
		50	NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2
		20	NP	10.5	10.5	7.5	6.4
D_0		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3
		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
D_1		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1

		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
D_2		10	NP	4.0	4.0	2.5	2.1
		20	NP	8.0	8.0	5.0	4.3
		30	NP	12.0	12.0	7.5	6.4
		40	NP	16.0	16.0	10.0	8.5
		50	NP	20.0	20.0	12.5	10.6
		10	NP	7.5	7.5	5.5	4.7
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
	Cripple wall below one- or two-story dwelling	10	NP	NP	NP	7.5	6.4
		20	NP	NP	NP	15.0	12.8
		30	NP	NP	NP	22.5	19.1
		40	NP	NP	NP	30.0	25.5
		50	NP	NP	NP	37.5	31.9

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

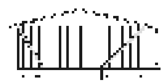
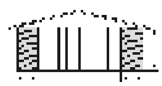
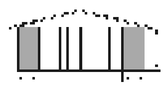
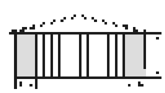
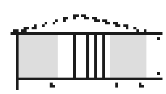
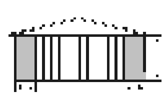
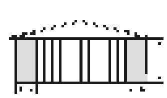
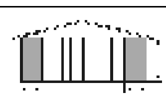
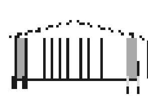
a. Linear interpolation shall be permitted.

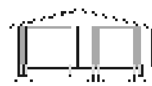
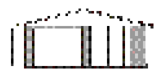
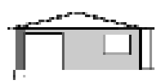
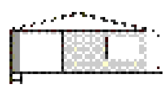
b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the Seismic Design Categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

c. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

d. ~~Method CS-SFB applies in SDC C only~~. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2.

TABLE R602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a] Fasteners	CONNECTION CRITERIA[a] Spacing
Intermittent Bracing Method	**LIB** Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16^{2} stud spacing		Wood: 2-8d common nails or 3-8d (2$^{1}/_{2}$″ long x 0.113″ dia.) nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	$^{3}/_{4}$″(1″ nominal) for maximum 24″ stud spacing		2-8d (2$^{1}/_{2}$″ long × 0.113″ dia.) nails or 2 - 1$^{3}/_{4}$″ long staples	Per stud
	WSP Wood structural panel (See Section R604)	$^{3}/_{8}$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	BV-WSP[e] Wood Structural Panels with Stone or Masonry Veneer (See Section R602.10.6.5)	$^{7}/_{16}$″	See Figure R602.10.6.5	8d common (2$^{1}/_{2}$″ × 0.131) nails	4″ at panel edges 12″ at intermediate supports 4″ at braced wall panel end posts
	SFB Structural fiberboard sheathing	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16″ stud spacing		1$^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) 1$^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common (2$^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	GB Gypsum board	$^{1}/_{2}$″		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7″ edges (including top and bottom plates) 7″ field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	$^{3}/_{8}$″ or $^{1}/_{2}$″ for maximum 16″ stud spacing		For $^{3}/_{8}$″, 6d common (2″ long × 0.113″ dia.) nails For $^{1}/_{2}$″, 8d common (2$^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	PCP Portland cement plaster	See Section R703.6 for maximum 16″ stud spacing		1$^{1}/_{2}$″ long, 11 gage, $^{7}/_{16}$″ dia. head nails or $^{7}/_{8}$″ long, 16 gage staples	6″ o.c. on all framing members
	HPS Hardboard panel siding	$^{7}/_{16}$″ for maximum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate 1$^{1}/_{2}$″ penetration into studs	4″ edges 8″ field
	ABW Alternate braced wall	$^{3}/_{8}$″		See Section R602.10.6.1	See Section R602.10.6.1

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a]	
				Fasteners	Spacing
Intermittent Bracing Methods	**PFH** Portal frame with hold-downs	$^3/_8$″		See Section R602.10.6.2	See Section R602.10.6.2
	PFG Portal frame at garage	$^7/_{16}$″		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	$^3/_8$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	CS-G[b, c] Continuously sheathed wood structural panel adjacent to garage openings	$^3/_8$″		See Method CS-WSP	See Method CS-WSP
	CS-PF Continuously sheathed portal frame	$^7/_{16}$″		See Section R602.10.6.4	See Section R602.10.6.4
	CS-SFB[d] Continuously sheathed structural fiberboard	$^1/_2$″ or $^{25}/_{32}$″ for maximum 16" stud spacing		$1^1/_2$″ long × 0.12″ dia. (for $^1/_2$″ thick sheathing) $1^3/_4$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^1/_2$″ long × 0.131″ dia.) nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load may not exceed 3 psf.

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.

d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 ~~and in areas where the wind speed exceeds 100 mph~~.

e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.

Reason: Footnote c of Table R602.10.3(1), footnote d of Table R602.10.3(3), and footnote d of Table R602.10.4 were added to the 2012 IRC when provisions for the bracing method designated as Continuously-Sheathed Structural Fiberboard (CS-SFB) were combined with Continuously-Sheathed Wood Structural Panels (CS-WSP). Previous provisions in the 2009 IRC section R602.10.5.4 required CS-SFB used in Seismic Design Categories (SDC) D_0, D_1 and D_2 or regions where the basic wind speed exceeds 100 mph to be designed in accordance with accepted engineering practice and the provisions of the of *IBC*.

With changes to the 2012 IRC section R301.2.1.1 that clarified high-wind thresholds where engineered design and/or use of pre-engineered design provisions, such as those in the WFCM, must be used, Table R602.10.3(1) footnote “c” and the second portion of Table R602.10.4 footnote “d” are not needed. Deletion of these footnotes in combination with changes adopted into 2012 meet the original intent of the 2009 IRC.

The second portion of the change clarifies the intent of Table R602.10.3(3) footnote “d” which could be interpreted to mean that CS-SFB cannot be used in Seismic Design Categories A & B. This literal interpretation would be incorrect.

Cost Impact: The code change proposal will not increase the cost of construction.

RB295-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.3(1)T-RB-PITTS.doc

RB296 – 13
Table R602.10.3(2), Table R602.10.3(4)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a, b] [multiply length from Table R602.10.3(1) by this factor]	APPLICABLE METHODS
1	Exposure category	One-story structure	B	1.00	All methods
			C	1.20	
			D	1.50	
		Two-story structure	B	1.00	
			C	1.30	
			D	1.60	
		Three-story structure	B	1.00	
			C	1.40	
			D	1.70	
2	Roof eave-to-ridge height	Roof only	≤ 5 feet	0.70	
			10 feet	1.00	
			15 feet	1.30	
			20 feet	1.60	
		Roof + 1 floor	≤ 5 feet	0.85	
			10 feet	1.00	
			15 feet	1.15	
			20 feet	1.30	
		Roof + 2 floors	≤ 5 feet	0.90	
			10 feet	1.00	
			15 feet	1.10	
			20 feet	Not permitted	
3	Wall height adjustment	Any story	8 feet	0.90	
			9 feet	0.95	
			10 feet	1.00	
			11 feet	1.05	

ITEM NUMBER	ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a, b] [multiply length from Table R602.10.3(1) by this factor]	APPLICABLE METHODS
			412 feet	1.10	
4	Number of braced wall lines (per plan direction)[c]	Any story	2	1.00	
			3	1.30	
			4	1.45	
			≥ 5	1.60	
5	Additional 800-pound hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS
6	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB,PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
7	Gypsum board fastening	Any story	4 inches o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 4.48 N.

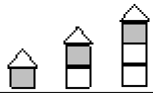
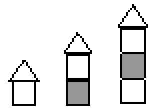
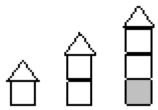
a. Linear interpolation shall be permitted.

b. The total adjustment factor is the product of all applicable adjustment factors.

c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a,b] (Multiply length from Table R602.10.3(~~1~~3) by this factor)	APPLICABLE METHODS
1	Story height (Section 301.3)	Any story	≤10 ft	1.0	All methods
			>10 ft and ≤ 12 ft	1.2	
2	Braced wall line spacing, townhouses in SDC C	Any story	≤35 ft	1.0	
			>35 ft and ≤ 50 ft	1.43	
3	*Braced wall line* spacing, in SDC D_0, D_1, D_2[c]	Any story	> 25 ft and ≤30 ft	1.2	
			>30 ft and ≤ 35 ft	1.4	
4	Wall dead load	Any story	> 8 psf and< 15 psf	1.0	
			<8 psf	0.85	
5	Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	≤15 psf	1.0	
		Roof plus one or two stories	>15 psf and ≤ 25 psf	1.1	
		Roof only	>15 psf and ≤ 25 psf	1.2	

ITEM NUMBER	ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (Multiply length from Table R602.10.3(~~1~~3) by this factor)	APPLICABLE METHODS
6	Walls with stone or masonry veneer, townhouses in SDC C [d,e]		1.0		~~All intermittent and continuous methods~~ All methods
			1.5		
			1.5		
7	Walls with stone or masonry veneer, detached one-and two-family dwellings in SDC D_0-D_2 [d]	Any story	See Table R602.10.6.5		BV-WSP
8	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of *braced wall panels*	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

For SI: 1 psf = 47,8 N/m^2.
a. Linear interpolation shall be permitted.
b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.
c. The length-to-width ratio for the floor/roof *diaphragm* shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.
d. Applies to stone or masonry veneer exceeding the first story height. See Section R602.10.6.5 for requirements when stone or masonry veneer does not exceed the first story height.
e. The adjustment factor for stone or masonry veneer shall be applied to all exterior *braced wall lines* and all *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supported veneered walls.

Reason: This proposal corrects a couple of editorial deficiencies in the table that were discovered by APA and ICC Staff while writing the 2012 IRC Bracing Book. These can be seen in the 6th row (using proposed item numbering) where “C” was left out behind SDC in the “Adjustment based on” column. Also in the last column on the right the annotation “All intermittent and continuous methods” was changed to the format used elsewhere in the column. Note also that the proposal references the correct table in the column heading (**Adjustment Factor**…).

Adding item numbers could also be considered an editorial item. This is a format used in other large tables (e.g., Table R602.3(1)) where making reference to a specific entry is relatively difficult.

Cost Impact: The code change proposal will not increase the cost of construction.

RB296-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

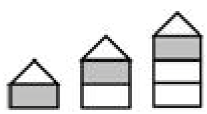
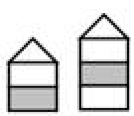
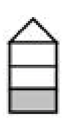
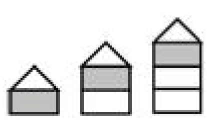
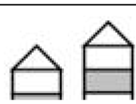
R602.10.3(2)T-RB-KEITH.doc

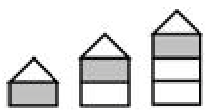
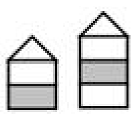
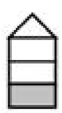
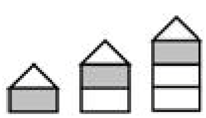
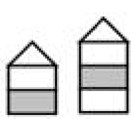
RB297 – 13
Table R602.10.3(3)

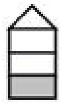
Proponent: Randall Shackelford, Simpson Strong-Tie Company (rshackelford@strongtie.com)

Revise as follows:

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)[c]**	**Method LIB[e d]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[d e]**	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
D_0		10	NP	2.8	2.8	1.8	1.6
		20	NP	5.5	5.5	3.6	3.1
		30	NP	8.3	8.3	5.4	4.6
		40	NP	11.0	11.0	7.2	6.1
		50	NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2
		20	NP	10.5	10.5	7.5	6.4

		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3
		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
D_1		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1
		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
		10	NP	4.0	4.0	2.5	2.1
		20	NP	8.0	8.0	5.0	4.3
		30	NP	12.0	12.0	7.5	6.4
		40	NP	16.0	16.0	10.0	8.5
D_2		50	NP	20.0	20.0	12.5	10.6
		10	NP	7.5	7.5	5.5	4.7
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4

		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
	Cripple wall below one- or two-story dwelling	10	NP	NP	NP	7.5	6.4
		20	NP	NP	NP	15.0	12.8
		30	NP	NP	NP	22.5	19.1
		40	NP	NP	NP	30.0	25.5
		50	NP	NP	NP	37.5	31.9

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the Seismic Design Categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.

~~c~~ d. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

~~d~~ e. Method CS-SFB applies in SDC C only.

Reason: The reason for this code change is to clarify that braced wall line lengths longer than 50 feet are permitted when bracing is determined based on Seismic Design Category.

The bracing amount table (R602.10.3(3)) currently specifies bracing only for braced wall line lengths of up to 50 feet. This gives the impression that braced wall line lengths longer than 50 feet are not permitted.

I do not believe this is the intent of this table.

This goes back to the work of the ICC Wall Bracing Committee when all the bracing amounts were converted from percentages sheathed to actual lengths sheathed. In the 2000-2006 IRC, the amount of bracing was just shown as a percentage of the length of the braced wall line. Theoretically, the braced wall line could be as long as the builder wanted it to be, and the amount of bracing would just go up as the length increased.

In an effort to decrease requirement for math calculations, the Wall Bracing Committee converted all percentages to lengths. I think since the spacing of braced wall lines was limited to a maximum of 50 feet, that number was also chosen as the maximum length of braced wall lines.

Theoretically, since the length of braced wall lines is permitted to be taken as the length between perpendicular braced wall lines, one could already divide up a long braced wall line into shorter braced wall lines with length less than 50 feet. But to avoid confusion, I think it is better to specifically clarify that.

Cost Impact: This proposal could lower costs in jurisdictions that were interpreting this table to limit braced wall line lengths to 50 feet by allowing larger houses to be built using IRC provisions instead of having to be designed.

RB297-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

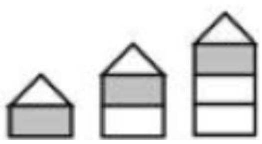
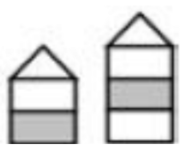
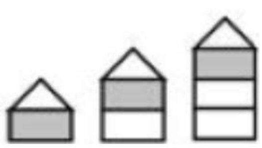
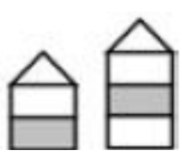
R602.10.3(3)T-RB-SHACKELFORD.doc

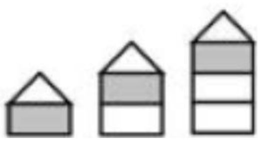
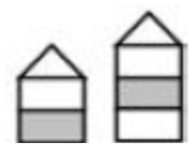
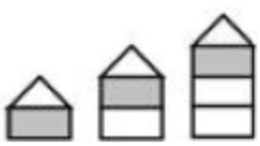
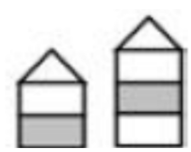
RB298 – 13
Table R602.10.3(3)

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

Table R602.10.3(3)
BRACING REQUIREMENTSBASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)**	**Method LIB[c]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[d]**	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	~~1.6~~ 2.0	1.4
		20	5.0	5.0	5.0	~~3.2~~ 4.0	2.7
		30	7.5	7.5	7.5	~~4.8~~ 6.0	4.1
		40	10.0	10.0	10.0	~~6.4~~ 8.0	5.4
		50	12.5	12.5	12.5	~~8.0~~ 10,0	6.8
		10	NP	4.5	4.5	~~3.0~~ 3.8	2.6
		20	NP	9.0	9.0	~~6.0~~ 7.5	5.1
		30	NP	13.5	13.5	~~9.0~~ 11.3	7.7
		40	NP	18.0	18.0	~~12.0~~ 15.0	10.2
		50	NP	22.5	22.5	~~15.0~~ 18.8	12.8
		10	NP	6.0	6.0	~~4.5~~ 5.6	3.8
		20	NP	12.0	12.0	~~9.0~~ 11.3	7.7
		30	NP	18.0	18.0	~~13.5~~ 16.9	11.5
		40	NP	24.0	24.0	~~18.0~~ 22.5	15.3
		50	NP	30.0	30.0	~~22.~~5 28.1	19.1
D_0		10	NP	2.8	2.8	~~1.8~~ 2.3	1.6
		20	NP	5.5	5.5	~~3.6~~ 4.5	3.1
		30	NP	8.3	8.3	~~5.4~~ 6.8	4.6
		40	NP	11.0	11.0	~~7.2~~ 9.0	6.1
		50	NP	13.8	13.8	~~9.0~~ 11.3	7.7
		10	NP	5.3	5.3	~~3.8~~ 4.8	3.2
		20	NP	10.5	10.5	~~7.5~~ 9.4	6.4
		30	NP	15.8	15.8	~~11.3~~ 14.1	9.6
		40	NP	21.0	21.0	~~15.0~~ 18.8	12.8
		50	NP	26.3	26.3	~~18.8~~	16.0

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			**MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]**				
						23.5	
		10	NP	7.3	7.3	~~5.3~~ 6.6	4.5
		20	NP	14.5	14.5	~~10.5~~ 13.1	9.0
		30	NP	21.8	21.8	~~15.8~~ 19.8	13.4
		40	NP	29.0	29.0	~~21.0~~ 26.3	17.9
		50	NP	36.3	36.3	~~26.3~~ 32.9	22.3
D_1		10	NP	3.0	3.0	~~2.0~~ 2.5	1.7
		20	NP	6.0	6.0	~~4.0~~ 5.0	3.4
		30	NP	9.0	9.0	~~6.0~~ 7.5	5.1
		40	NP	12.0	12.0	~~8.0~~ 10	6.8
		50	NP	15.0	15.0	~~10.0~~ 12.5	8.5
		10	NP	6.0	6.0	~~4.5~~ 5.6	3.8
		20	NP	12.0	12.0	~~9.0~~ 11.3	7.7
		30	NP	18.0	18.0	~~13.5~~16.9	11.5
		40	NP	24.0	24.0	~~18.0~~22.5	15.3
		50	NP	30.0	30.0	~~22.5~~28.1	19.1
		10	NP	8.5	8.5	~~6.0~~ 7.5	5.1
		20	NP	17.0	17.0	~~12.0~~15.0	10.2
		30	NP	25.5	25.5	~~18.~~ 22.5	15.3
		40	NP	34.0	34.0	~~24.0~~ 30.0	20.4
		50	NP	42.5	42.5	~~30.0~~ 37.5	25.5
D_2		10	NP	4.0	4.0	~~2.5~~ 3.1	2.1
		20	NP	8.0	8.0	~~5.0~~ 6.3	4.3
		30	NP	12.0	12.0	~~7.5~~ 9.4	6.4
		40	NP	16.0	16.0	~~10.0~~12.5	8.5
		50	NP	20.0	20.0	~~12.5~~15.6	10.6
		10	NP	7.5	7.5	~~5.5~~ 6.9	4.7
		20	NP	15.0	15.0	~~11.0~~13.8	9.4
		30	NP	22.5	22.5	~~16.5~~20.6	14.0
		40	NP	30.0	30.0	~~22.0~~27.5	18.7
		50	NP	37.5	37.5	~~27.5~~34.4	23.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
	Cripple wall below one- or two- story building	10	NP	NP	NP	~~7.5~~ 9.4	6.4
		20	NP	NP	NP	~~15.0~~ 18.8	12.8
		30	NP	NP	NP	~~22.5~~ 28.1	19.1
		40	NP	NP	NP	~~30.0~~ 37.5	25.5

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			**MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]**				
		50	NP	NP	NP	~~37.5~~ 46.9	31.9

Reason: The purpose of this proposal is to adjust the current required minimum wall bracing for WSP method for seismic design using nominal strength and factors of safety consistent with IBC.

IRC wall bracing capacity is based on tests that utilized partial restraint in the form of return walls at each end of the wall and gypsum board panels [1]. Tests have shown that shear wall strength value is a function of the overturning restraint provided. The IBC allowable seismic shear strength relies on restraint from dead load or overturning restraint devices and does not consider additional contribution of gypsum board for capacity unless using a reduced seismic response modification coefficient, R.

The allowable unit shear capacity of 315 plf for seismic bracing was used in determining bracing length for IRC and is based on a factor of safety of 2.0. The IRC capacity includes the contribution of ½" gypsum board attached to the opposite side of the wood structural sheathing.

For the same nailing schedule (7/16" OSB, 8d common, 6/12), IBC allowable unit shear is 255 plf and based on a factor of safety of 2.8. The proposed adjustment for Table R602.10.3(3) is intended to bring the capacities into alignment by increasing the required wall bracing in the IRC by a factor of 315plf /255 plf ≈ 1.25. While there are additional considerations including seismic response for the wall bracing system and assumed percentage of partial restraint, the intent for this proposal is to align capacity and safety factors for both IBC and IRC for seismic design.

References

Sequential Phased Displacement Tests of Wood-frame Shear Walls with Corners, Report No. TE-1997-003, by J.D. Dolan and C.P. Heine, Brooks Forest Products Research Center, VPI&SU, Blacksburg, VA. September 14, 1997.

Cost Impact: The code change proposal will increase the cost of construction. It will be a minor increase.

RB298-13

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

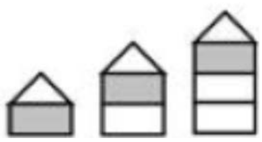
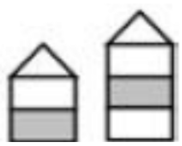
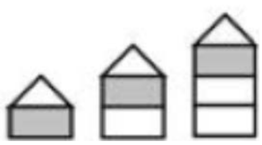
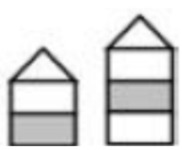
R602.10.3(3)T #1-RB-MLAKAR-MOORE.doc

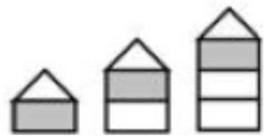
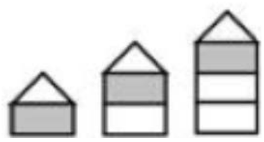
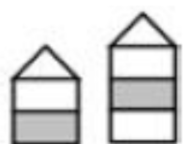
RB299 – 13
Table R602.10.3(3)

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

Table R602.10.3(3)
BRACING REQUIREMENTSBASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)**	**Method LIB[c]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[d]**	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	1.6	~~1.4~~ 1.8
		20	5.0	5.0	5.0	3.2	~~2.7~~ 3.5
		30	7.5	7.5	7.5	4.8	~~4.1~~ 5.3
		40	10.0	10.0	10.0	6.4	~~5.4~~ 7.0
		50	12.5	12.5	12.5	8.0	~~6.8~~ 8.8
		10	NP	4.5	4.5	3.0	~~2.6~~ 3.4
		20	NP	9.0	9.0	6.0	~~5.1~~ 6.6
		30	NP	13.5	13.5	9.0	~~7.7~~ 10.0
		40	NP	18.0	18.0	12.0	~~10.2~~ 13.3
		50	NP	22.5	22.5	15.0	~~12.8~~ 16.6
		10	NP	6.0	6.0	4.5	~~3.8~~ 5.0
		20	NP	12.0	12.0	9.0	~~7.7~~ 10.0
		30	NP	18.0	18.0	13.5	~~11.5~~ 15.0
		40	NP	24.0	24.0	18.0	~~15.3~~ 20.0
		50	NP	30.0	30.0	22.5	~~19.1~~ 24.8
D_0		10	NP	2.8	2.8	1.8	~~1.6~~ 2.1
		20	NP	5.5	5.5	3.6	~~3.1~~ 4.0
		30	NP	8.3	8.3	5.4	~~4.6~~ 6.0
		40	NP	11.0	11.0	7.2	~~6.1~~ 8.0
		50	NP	13.8	13.8	9.0	~~7.7~~ 10
		10	NP	5.3	5.3	3.8	~~3.2~~ 4.2
		20	NP	10.5	10.5	7.5	~~6.4~~ 8.3
		30	NP	15.8	15.8	11.3	~~9.6~~ 12.5
		40	NP	21.0	21.0	15.0	~~12.8~~ 16.6
		50	NP	26.3	26.3	18.8	~~16.0~~ 20.8
		10	NP	7.3	7.3	5.3	~~4.5~~ 5.9
		20	NP	14.5	14.5	10.5	~~9.0~~ 11.7
		30	NP	21.8	21.8	15.8	~~13.4~~ 17.4
		40	NP	29.0	29.0	21.0	~~17.9~~ 23.3
		50	NP	36.3	36.3	26.3	~~22.3~~ 29.0

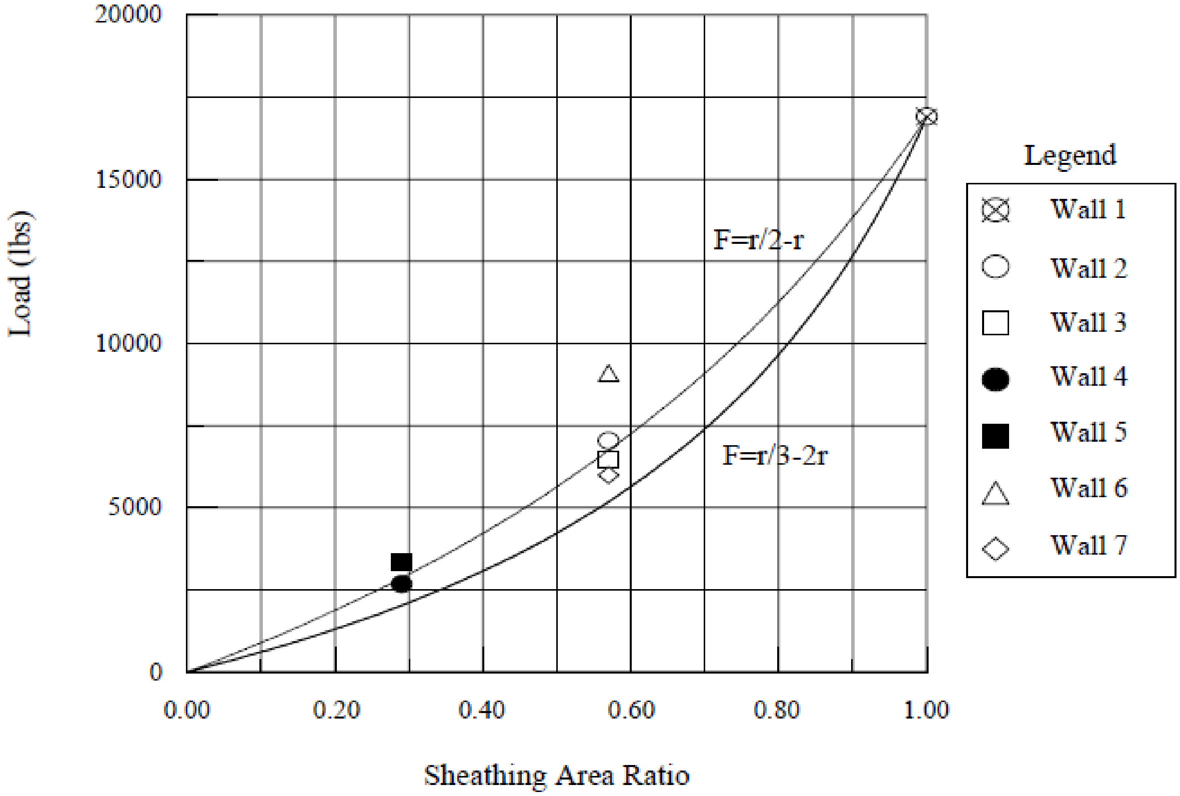
• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
D_1		10	NP	3.0	3.0	2.0	~~1.7~~ 2.2
		20	NP	6.0	6.0	4.0	~~3.4~~ 4.4
		30	NP	9.0	9.0	6.0	~~5.1~~ 6.6
		40	NP	12.0	12.0	8.0	~~6.8~~ 8.8
		50	NP	15.0	15.0	10	~~8.5~~ 11.0
		10	NP	6.0	6.0	4.5	~~3.8~~ 5.0
		20	NP	12.0	12.0	9.0	~~7.7~~ 10.0
		30	NP	18.0	18.0	13.5	~~11.5~~ 15.0
		40	NP	24.0	24.0	18.0	~~15.3~~ 19.9
		50	NP	30.0	30.0	22.5	~~19.1~~ 24.8
		10	NP	8.5	8.5	6.0	~~5.1~~ 6.6
		20	NP	17.0	17.0	12.0	~~10.2~~ 13.3
		30	NP	25.5	25.5	18.0	~~15.3~~ 19.9
		40	NP	34.0	34.0	24.0	~~20.4~~ 26.5
		50	NP	42.5	42.5	30.0	~~25.5~~ 33.2
D_2		10	NP	4.0	4.0	2.5	~~2.1~~ 2.7
		20	NP	8.0	8.0	5.0	~~4.3~~ 5.6
		30	NP	12.0	12.0	7.5	~~6.4~~ 8.3
		40	NP	16.0	16.0	10.0	~~8.5~~ 11.0
		50	NP	20.0	20.0	12.5	~~10.6~~ 13.8
		10	NP	7.5	7.5	5.5	~~4.7~~ 6.1
		20	NP	15.0	15.0	11.0	~~9.4~~ 12.2
		30	NP	22.5	22.5	16.5	~~14.0~~ 18.2
		40	NP	30.0	30.0	22.0	~~18.7~~ 24.3
		50	NP	37.5	37.5	27.5	~~23.4~~ 30.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
	Cripple wall below one- or two- story building	10	NP	NP	NP	7.5	~~6.4~~ 8.3
		20	NP	NP	NP	15.0	~~12.8~~ 16.6
		30	NP	NP	NP	22.5	~~19.1~~ 24.8
		40	NP	NP	NP	30.0	~~25.5~~ 33.2
		50	NP	NP	NP	37.5	~~31.9~~ 41.5

Reason: The purpose of this proposed code change is to adjust the current required minimum wall bracing for CS-WSP, CS-G methods for seismic designs using nominal strength and factor of safety consistent with IBC. It entails the following adjustments:

1) Use F=r/(3-2r) for perforated shear walls (PSW) to determine strength for Continuous Sheathed Wood Structural Panel (CS-WSP) and Continuously Sheathed Wood Structural Panel Adjacent to Garage Openings (CS-G) bracing methods.
2) Use unit shear capacity consistent with IBC for (7/16" OSB, 8d common, 6/12) to determine wall bracing strength for CS-WSP and CS-G.
3) Revise minimum braced wall panels for CS-WSP and CS-G bracing method in Table R602.10.3(3) based on items 1 and 2 above.

The IBC solution for design of perforated shear wall is based on AWC SDPWS which uses F=r/(3-2r) for modeling PSW that envelopes strength measured by tests. IRC uses F=r/(2-r) which better represents the average of tests available.

Comparison of tests using the IRC model show some walls may be under designed as shown in the following graph. The two models shown represent the design capacity of the PSW used by IBC and IRC. The proposed values shown in Table R602.10.3(3) represent an increase of required wall length by a factor of 1.3. This ratio is the approximation for the largest difference between the two models shown below. This represents a conservative approach to establish consistency in factors of safety with IBC. A more refined adjustment is required to evaluate the bracing length requirements if the unit shear strength is adjusted as proposed in number 2 of this proposal. The data points represent measured capacity of the various wall openings.



References

1) J.D. Dolan and C.P., 1997 "Heine Sequential Phased Displacement Tests of Wood-frame Shear Walls with Corners," Report No. TE-1997-003, Brooks Forest Products Research Center, VPI&SU, Blacksburg, VA. September 14, 1997.
2) NAHB Research Center, Inc., 1998 "The Performance of Perforated Shear Walls with Narrow Wall Segments, Reduced Base Restraint, and Alternative Framing Methods," National Association of Home Builders and the U.S. Department of Housing and Urban Development, Washington, DC. May 1998.

Cost Impact: This code change proposal will not increase construction cost.

RB299-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

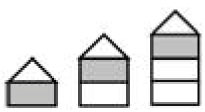
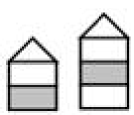
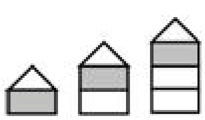
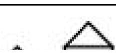
R602.10.3(3)T #2-RB-MLAKAR-MOORE.doc

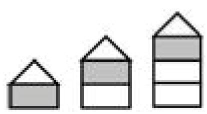
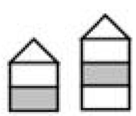
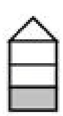
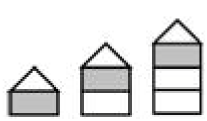
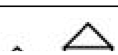
RB300 – 13
Table R602.10.3(3)

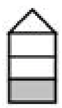
Proponent: Louis Wagner, Executive Director, North American Fiberboard Association (lwagner@fiberboard.org)

Revise as follows:

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)**	**Method LIB[c]**	**Method GB**	**Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[d]**	**Method WSP**	**Methods CS-WSP, CS-G**
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
D_0		10	NP	2.8	2.8	1.8	1.6
		20	NP	5.5	5.5	3.6	3.1
		30	NP	8.3	8.3	5.4	4.6
		40	NP	11.0	11.0	7.2	6.1
		50	NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
		20	NP	10.5	10.5	7.5	6.4
		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3
D_1		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1
		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
D_2		10	NP	4.0	4.0	2.5	2.1
		20	NP	8.0	8.0	5.0	4.3
		30	NP	12.0	12.0	7.5	6.4
		40	NP	16.0	16.0	10.0	8.5
		50	NP	20.0	20.0	12.5	10.6
		10	NP	7.5	7.5	5.5	4.7

• SOIL CLASS D[b] • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a]				
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4
		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
	Cripple wall below one- or two-story dwelling	10	NP	NP	NP	7.5	6.4
		20	NP	NP	NP	15.0	12.8
		30	NP	NP	NP	22.5	19.1
		40	NP	NP	NP	30.0	25.5
		50	NP	NP	NP	37.5	31.9

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the Seismic Design Categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

c. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

d. Method CS-SFB applies in SDC ~~C only~~ D_0, D_1 and D_2 as allowed in Section R602.10.22.1.

Reason: Section R602.10.22.1 allows CS-SFB to be used in zones D_0, D_1 and D_2 with the added requirement of a minimum panel width of 32" instead of the 24" minimum required for other continuous sheathings. This was part of an agreement reached during meetings of the Ad Hoc Committee on wall Bracing.

Related code changes have been submitted for TABLE R602.10.3(1) Footnote c, TABLE R602.10.3(3) Footnote d and Table R602.10.4 Footnote d. All three should be heard together.

Cost Impact: The code change proposal will not increase the cost of construction.

RB300-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.3(3)T #1-RB-WAGNER.doc

RB301 – 13
Table R602.10.3(4)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] (Multiply length from Table R602.10.3(3) by this factor.)	APPLICABLE METHODS
Roof/ceiling dead load for wall supporting	1, 2 or 3 story building ~~Roof only or roof plus one or two stories~~	≤ 15 psf	1.0	All methods
	~~Roof plus one or two stories~~ 2 or 3 story building	>15 psf and ≤ 25 psf	1.1	
	~~Roof only~~ 1 story building	>15 psf and ≤ 25 psf	1.2	

(Portions of Table not shown remain unchanged)

Reason: The purpose of this code change is to make this provision of the code clear and unambiguous. The current language is subject to interpretation. The term "roof" reference in the "**STORY/SUPPORTING"** column represents a roof and its supporting walls, i.e., single story. Thus, "roof only" is the roof + walls of a single story, "roof plus one or two stories" is a 2 or 3 story building, and "Roof only plus one or two stories" is a 1, 2 or 3 story building.

Without knowledge of the intent and just reading the entries in the "**STORY/SUPPORTING**" column it would be easy to misinterpret the intent of the code. For example "roof plus one or two stories" *sounds* like a 1 or 2 story building. But the intent of the code is "roof *and supporting walls* plus one or two *additional* stories", or a 2 or 3 story building.

At 15 psf or less 1, 2 or 3 story buildings require no adjustment to the amount of bracing required. Between 15 and a maximum of 25 psf, the adjustment factor depends on the number of stories involved. This portion was not impacted by the proposed change.

We are asking the committee to please support the clarifying language, to better represent the intent of the IRC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB301-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.3(4)T #1-RB-KEITH.doc

RB302 – 13
Table R602.10.3(4)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR [a,b] [Multiply length from Table R602.10.3(3) by this factor]	APPLICABLE METHODS
Walls with stone or masonry veneer, town-houses in SDC-C [~~d~~,e,f]	(Figure)	1.0		All intermittent and continuous methods
	(Figure)	1.5		
	(Figure)	1.5		

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.

c. The length-to-width ratio for the floor/roof *diaphragm* shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.

d. Applies to stone or masonry veneer exceeding the first story height. See Section R602.10.6.5 for requirements when stone or masonry veneer does not exceed the first story height.

e. The adjustment factor for stone or masonry veneer shall be applied to all exterior *braced wall lines* and all *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supported veneered walls.

f. Applies to stone and masonry veneer exceeding the first story height and not extending up into the gable end.

(Portions of Table not shown remain unchanged)

Reason: The purpose of these proposals is to clarify the IRC.

1. The reference to Section R602.10.6.5 in the second portion of Footnote d is clearly applicable to SDCs D_0, D_1 and D_2 only. The above portion of the table is applicable to townhouses in SDC C. It is confusing referencing a footnote, part of which is clearly not relevant. It calls into question the relevant portions of the footnote. As the first portion of footnote d is applicable to townhouses in SDC C, to avoid confusion we propose the relevant information be duplicated in its own Footnote f.
2. The second portion of the proposed footnote adds the gable end to the not-to-extend criteria. The IRC is clear that the line of demarcation between using the standard bracing provisions and the Method BV-WSP is when the brick or masonry veneer extends up past the first story height. It is not clear what to do when the veneer extends up the gable-end wall. The definition of story in Chapter 2 provided below could lead one to believe that the gable–end wall was part of the story below:

   STORY. *That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.*

   From a structural perspective, however the mass in a gable end-wall can equal or exceed the mass of a veneered second story. For example, a 40-foot wide building with a 12:12 pitch can have gable-end wall that is a maximum of 20 feet tall above the top of the wall below. As the area is triangular the average height of this gable-end wall is 10 feet tall. This is the same mass as a veneered 10 foot second story wall.

   It is clearly NOT the intent of the IRC to permit the standard bracing provisions for only a single story UNLESS the same or larger mass is part of a gable-end wall. The above proposal clarifies the intent of this section with respect to veneered gable-end walls.

   This portion of the proposed change is duplicated in another code change proposal.

Cost Impact: The code change proposal will not increase the cost of construction.

RB302-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

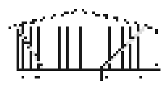
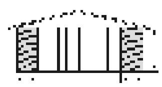
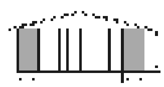
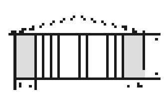
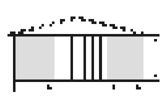
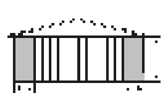
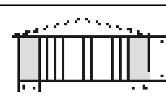
R602.10.3(4)T #2-RB-KEITH.doc

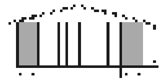
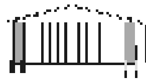
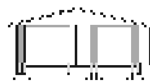
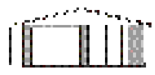
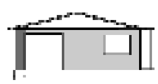
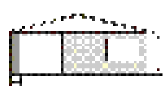
RB303 – 13
Table R602.10.4

Proponent: Louis Wagner, Executive Director, North American Fiberboard Association (lwagner@fiberboard.org)

Revise as follows:

TABLE R602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a]	
				Fasteners	Spacing
Intermittent Bracing Method	**LIB** Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16″ stud spacing		Wood: 2-8d common nails or 3-8d ($2^{1}/_{2}$″ long x 0.113″ dia.) nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	$^{3}/_{4}$″(1″ nominal) for maximum 24″ stud spacing		2-8d ($2^{1}/_{2}$″ long × 0.113″ dia.) nails or 2 - $1^{3}/_{4}$″ long staples	Per stud
	WSP Wood structural panel (See Section R604)	$^{3}/_{8}$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	BV-WSP[e] Wood Structural Panels with Stone or Masonry Veneer (See Section R602.10.6.5)	$^{7}/_{16}$″	See Figure R602.10.6.5	8d common ($2^{1}/_{2}$″ × 0.131) nails	4″ at panel edges 12″ at intermediate supports 4″ at braced wall panel end posts
	SFB Structural fiberboard sheathing	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16″ stud spacing		$1^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) $1^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	GB Gypsum board	$^{1}/_{2}$″		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7″ edges (including top and bottom plates) 7″ field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	$^{3}/_{8}$″ or $^{1}/_{2}$″ for maximum 16″ stud spacing		For $^{3}/_{8}$″, 6d common (2″ long × 0.113″ dia.) nails For $^{1}/_{2}$″, 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	PCP Portland cement plaster	See Section R703.6 for maximum 16″ stud spacing		$1^{1}/_{2}$″ long, 11 gage, $^{7}/_{16}$″ dia. head nails or $^{7}/_{8}$″ long, 16 gage staples	6″ o.c. on all framing members

	METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a] Fasteners	CONNECTION CRITERIA[a] Spacing
	HPS Hardboard panel siding	$^{7}/_{16}$″ for maximum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate $1^{1}/_{2}$″ penetration into studs	4″ edges 8″ field
	ABW Alternate braced wall	$^{3}/_{8}$″		See Section R602.10.6.1	See Section R602.10.6.1
Intermittent Bracing Methods	**PFH** Portal frame with hold-downs	$^{3}/_{8}$″		See Section R602.10.6.2	See Section R602.10.6.2
Intermittent Bracing Methods	**PFG** Portal frame at garage	$^{7}/_{16}$″		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	$^{3}/_{8}$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
Continuous Sheathing Methods	**CS-G**[b, c] Continuously sheathed wood structural panel adjacent to garage openings	$^{3}/_{8}$″		See Method CS-WSP	See Method CS-WSP
Continuous Sheathing Methods	**CS-PF** Continuously sheathed portal frame	$^{7}/_{16}$″		See Section R602.10.6.4	See Section R602.10.6.4
Continuous Sheathing Methods	**CS-SFB**[d] Continuously sheathed structural fiberboard	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16" stud spacing		$1^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) $1^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load may not exceed 3 psf.

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.

d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 ~~and in areas where the wind speed exceeds 100 mph.~~ except as allowed in Section R602.10.22.1.

e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.

Reason: Section R602.10.22.1allows CS-SFB to be used in zones D_0, D_1 and D_2 with the added requirement of a minimum panel width of 32" instead of the 24" minimum required for other continuous sheathings. This was part of an agreement reached during meetings of the Ad Hoc Committee on wall Bracing.

There is a logical inconsistency in prohibiting CS-SFB when SFB which uses less bracing material is permitted. CS-SFB has already been penalized by ranking it lower than other continuous sheathings.

Related code changes have been submitted for Table R602.10.3(1) Footnote c, Table R602.10.3(3) Footnote d and Table R602.10.4 Footnote d. All three should be heard together.

Cost Impact: The code change proposal will not increase the cost of construction.

RB303-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

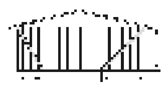
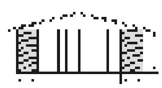
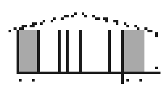
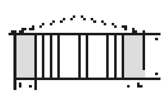
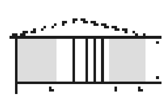
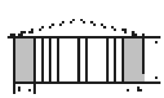
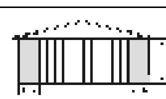
R602.10.4T-RB-WAGNER.doc

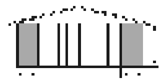
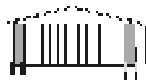
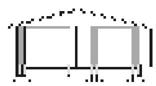
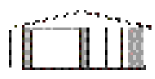
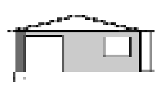
RB304 – 13
Table R602.10.4

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

TABLE R602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a]	
				Fasteners	Spacing
Intermittent Bracing Method	**LIB** Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16″ stud spacing		Wood: 2-8d common nails or 3-8d ($2^1/_2$″ long x 0.113″ dia.) nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	$^3/_4$″(1″ nominal) for maximum 24″ stud spacing		2-8d ($2^1/_2$″ long × 0.113″ dia.) nails or 2 - $1^3/_4$″ long staples	Per stud
	WSP Wood structural panel (See Section R604)	~~$^3/_8$″~~ 7/16”		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	BV-WSP[e] Wood Structural Panels with Stone or Masonry Veneer (See Section R602.10.6.5)	$^7/_{16}$″	See Figure R602.10.6.5	8d common ($2^1/_2$″ × 0.131) nails	4″ at panel edges 12″ at intermediate supports 4″ at braced wall panel end posts
	SFB Structural fiberboard sheathing	$^1/_2$″ or $^{25}/_{32}$″ for maximum 16″ stud spacing		$1^1/_2$″ long × 0.12″ dia. (for $^1/_2$″ thick sheathing) $1^3/_4$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^1/_2$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	GB Gypsum board	$^1/_2$″		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7″ edges (including top and bottom plates) 7″ field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	$^3/_8$″ or $^1/_2$″ for maximum 16″ stud spacing		For $^3/_8$″, 6d common (2″ long × 0.113″ dia.) nails For $^1/_2$″, 8d common ($2^1/_2$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	PCP Portland cement plaster	See Section R703.6 for maximum 16″ stud spacing		$1^1/_2$″ long, 11 gage, $^7/_{16}$″ dia. head nails or $^7/_8$″ long, 16 gage staples	6″ o.c. on all framing members

	METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a] Fasteners	CONNECTION CRITERIA[a] Spacing
	HPS Hardboard panel siding	$^{7}/_{16}$″ for maximum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate $1^{1}/_{2}$″ penetration into studs	4″ edges 8″ field
	ABW Alternate braced wall	~~3/8″~~ 7/16”		See Section R602.10.6.1	See Section R602.10.6.1
Intermittent Bracing Methods	**PFH** Portal frame with hold-downs	~~3/8″~~ 7/16”		See Section R602.10.6.2	See Section R602.10.6.2
Intermittent Bracing Methods	**PFG** Portal frame at garage	$^{7}/_{16}$″		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	~~3/8″~~ 7/16”		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
Continuous Sheathing Methods	**CS-G**[b, c] Continuously sheathed wood structural panel adjacent to garage openings	~~3/8″~~ 7/16”		See Method CS-WSP	See Method CS-WSP
Continuous Sheathing Methods	**CS-PF** Continuously sheathed portal frame	$^{7}/_{16}$″		See Section R602.10.6.4	See Section R602.10.6.4
Continuous Sheathing Methods	**CS-SFB**[d] Continuously sheathed structural fiberboard	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16" stud spacing		$1^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) $1^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load may not exceed 3 psf.

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.

d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 and in areas where the wind speed exceeds 100 mph.

e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.

Reason: The IRC wall bracing capacity for WSP, CS-WSP and CS-G in Table R602.10.4 are currently based on research from Virginia Tech as reported in TE-1997-003. The wood structural panel sheathing used in the test specimen was 7/16” OSB with 1/2” gypsum board sheathing on the opposite side of 2x framing.
The 2012 IRC Table R602.10.3(3) bracing requirements are based on a nominal strength of 634 plf with safety factor of 2 used as

design value for application of perforated shear wall to determine WSP, CS-WSP and CS-G minimum braced wall lengths.
In addition the joint task force of the City of Los Angeles Department of Building and Safety and the Structural Engineers Association of Southern California (SEAOSC) reported observed failures from the 1994 Northridge earthquake that occurred at the inner ply joint line of 3/8" three-ply plywood. The task force attributed the failure to a greater detrimental effect of overdriven fasteners with 3/8" three-ply plywood as compared to thicker plywood sheathing.

References

1) J.D. Dolan and C.P. Heine, 1997, "Sequential Phased Displacement Tests of Wood-frame Shear Walls with Corners," Report No. TE-1997-003, Brooks Forest Products Research Center, VPI&SU, Blacksburg, VA. September 14, 1997.

2) B. Schmidt, R. Harder, circa 1994, "Report on Plywood Shear Wall Performance," City of Los Angeles Department of Building and Safety and Structural Engineers Associations of Southern California Joint Task Force Plywood Shear Wall Committee,

Cost Impact: This code change proposal may increase construction cost.

RB304-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4T-RB-MLAKAR-MOORE.doc

RB305 – 13
R602.10.4.1

Proponent: Edward L. Keith, APA – The Engineered Wood Association(ed.keith@apawood.org)

Revise as follows:

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from *braced wall line* to *braced wall line* within a story shall be permitted. Within Seismic Design Categories A, B and C or and in regions where the basic wind speed is less than or equal to 100 mph (45 m/s), mixing of intermittent bracing and continuous sheathing methods from *braced wall line* to *braced wall line* within a story shall be permitted.
3. Mixing intermittent bracing methods along a *braced wall line* shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a *braced wall line* with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same *braced wall line* shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the *braced wall line*.

Reason: The intent of the code provision as written is that mixing bracing types from one braced wall line to another braced wall line within a story is to be permitted in areas of relatively low hazard. Thus BOTH criteria must be met - Seismic Design Categories A, B and C and where the basic wind speed is less than or equal to 100 mph (45 m/s). It was not the intent of the proposal to permit mixing when only one of the criteria was met, e.g., OK in SDC D_2 at 90 mph, or OK in <110 mph if SDC C. Both relatively low hazard criteria must be met.

Cost Impact: The code change proposal will not increase the cost of construction.

RB305-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4.1 #1-RB-KEITH.doc

RB306 – 13
R602.10.4.1

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from *braced wall line* to *braced wall line* within a story shall be permitted. Within Seismic Design Categories A, B and C or in regions where the basic wind speed is less than or equal to 100 mph (45 m/s), mixing of intermittent bracing and continuous sheathing methods from *braced wall line* to *braced wall line* within a story shall be permitted.
3. Mixing intermittent bracing methods along a *braced wall line* shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted. <u>Intermittent methods ABW, PFH, and PFG shall also be permitted to be used along a braced wall line with continuous sheathed methods.</u>
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a *braced wall line* with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same *braced wall line* shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the *braced wall line*.

Reason: It was never the intent of the Ad Hoc Bracing Committee to restrict the shear wall and portal frame methods (Methods ABW, PFH, and PFG) only for use with the intermittent bracing methods. These three methods have their basis in the alternate bracing methods of the 2006 IRC and were developed principally for use at garage door locations and other locations where full length bracing panels are not practical. Such situations are common to most structures whether intermittent or continuous methods are used. There is no rational reason to restrict their use to intermittent bracing only.

Note that the anchorage requirements of the Methods PFH and ABW meets or exceeds the normally-required anchorage requirements of the continuously sheathed return corner, 800 lbf or 1,800 lbf alternative. If used, the Method PFG portal would have to comply with the corner requirements of Sections R602.10.2.2.1 and/or R602.10.7, as applicable.

Cost Impact: The code change proposal will not increase the cost of construction.

RB306-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4.1 #2-RB-KEITH.doc

RB307 – 13
R602.10.4.1

Proponent: Randall Shackelford, P.E., Simpson Strong-Tie Company, Inc., (rshackelford@strongtie.com)

Revise as follows:

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from *braced wall line* to *braced wall line* within a story shall be permitted. <u>In regions</u> within Seismic Design Categories A, B and C ~~or in regions~~ where the basic wind speed is less than or equal to 100 mph (45 m/s), mixing of intermittent bracing and continuous sheathing methods from *braced wall line* to *braced wall line* within a story shall be permitted.
3. Mixing intermittent bracing methods along a *braced wall line* shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C provided the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a *braced wall line* shall be permitted.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a *braced wall line* with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same *braced wall line* shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the *braced wall line*.

Reason: The reason for this proposal is to clarify when intermittent and continuous bracing methods can be mixed within a story. I believe the "or" needs to be deleted because the language is too permissive and the sentence needs to be re-written so that the location has to be in SDC A, B, or C <u>and</u> have a basic windspeed ≤ 100 mph.

As currently written, because of the use of the term "or", a structure could be located within Seismic Design Category D_2, but as long as the basic wind speed is less than or equal to 100 mph, it would be permitted to have braced wall lines on the same story with different bracing methods.

That is not the intention of these provisions as they were originally written. The original intent was to limit mixing of intermittent and continuous methods to lower wind and lower seismic areas. In higher hazard areas, it is not advisable to mix braced wall lines of intermittent and continuous bracing methods in the same story because there can be a stiffness difference between the various methods.

The revised wording restores the original intent of this section.

Cost Impact: The main impact of this will be in higher seismic areas where constructing braced wall lines on the same story of intermittent and continuous bracing methods will be clearly prohibited (as it should have been all along). There conceivably could be a slight cost increase if a builder were using intermittent bracing methods with inexpensive sheathing between braces on some walls, and continuous sheathing on other walls on the same story, and had to change all walls to continuous sheathing so a continuous portal frame could be used.

RB307-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4.1-RB-SHACKELFORD.doc

RB308 – 13
R602.10.4.4 (NEW), Table R602.10.4.4 (NEW)

Proponent: Kirk Grundahl, Qualtim, representing the Structural Building Components Association (SBCA) (kgrundahl@qualtim.com)

Add new text as follows:

R602.10.4.4 Design Values. For the purpose of braced wall design, the capacity of wood structural panels to resist lateral loads, as found in Table R 602.10.3(1) are found in Table R602.10.4.4.

TABLE R602.10.4.4
SIMPLIFIED SHEAR VALUES FOR BRACED WALL LINES

Sheathing Material	Bottom plate connection to foundation	Fastener	Fastener Spacing	Any Species Stud Framing		
				Tested capacity	System Effects Factor	IRC Lateral Design Capacity
3/8", 7/16" or 15/32" WSP @16" and 24" o.c framing -- Wind.	Anchor bolts in accordance with code requirements	6d (2" x 0.113" nails) or 8d (2 1/2 x 0.131"	6:12	335	1.80	600
3/8", 7/16" or 15/32" WSP @16" and 24" o.c framing (with 1/2" gypsum on interior face of wall. -- Wind	Anchor bolts in accordance with code requirements	6d (2" x 0.113") or 8d (2 1/2 x 0.131"nails and Types S or W drywall screws.	6:12 WSP & 16:16 for GWB	465	1.80	840

a.The lateral design capacity of braced wall panels is based on full scale wall assembly tests using the minimum restraint provisions of the IRC, further adjusted by the partial restraint/systems effect factor.

Reason: Over the past several years, SBCRI has conducted a great deal of research into the requirements of the IRC, section R602.10 and the design capacity of wall assemblies built to those provisions. Table R602.10.3(1), Bracing Requirements Based on Wind Speed, was developed by the Ad-Hoc Wall Bracing Committee. The Lateral Design Capacity shown in the table above is the capacity determined by the committee to be used as the nominal strength of braced wall panels built to the minimum requirements of the IRC and using Method WSP. The braced wall panel lengths shown in Table R602.10.3(1) were calculated using these values. The system effect factor shown simply shows the factor required to be multiplied by the actual performance wood structural panels in buildings constructed to the minimum requirements of the IRC in order to achieve the stated lateral design capacity. This factor accounts for the increase in capacities due to additional framing, interior partitions, floor and ceiling framing, corner framing, etc. The tested capacities shown are the approximate capacities of wood structural panels used in buildings built to the minimum requirements of the IRC. Table R602.10.1 simply adds design value transparency to this section to show what the assumed system effect is once all of the building's construction detailing has been completed (i.e. additional strength from the addition of interior partitions, windows and doors, corner framing, interior gypsum, etc.). This approach is intended to be an aid to all registered design professionals as they make decisions about how best to resist applied loads and the safety considerations thereof. Full details of this research can be found at http://sbcri.info/bwpex.php and additional background on current design values is found here http://sbcri.info/bcters.php In addition, the Background on how the IRC wall bracing provisions were derived can be found in an article by Crandell-Martin in the spring 2009 edition of Wood Design Focus, " The Story Behind the 2009 IRC Wall Bracing Provisions (Part 2: New Wind Bracing Requirements)"

Cost Impact: This code change proposal will not increase the cost of construction.

RB308-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4.4 (NEW)-RB-GRUNDAHL.doc

RB309 – 13
R602.10.4.4 (NEW), Table R602.10.4.4 (NEW)

Proponent: Larry Wainright. Qualtim, representing the Structural Building Components Association (SBCA) (lwainright@qualtim.com)

Add new text as follows:

R602.10.4.4 Braced Wall Panel Design. Subject to the limitations of Section R602.10, the design of braced wall panels using the bracing methods defined in section R602.10.4 shall be in accordance with Table R602.10.4.4.

TABLE R602.10.4.4
BRACED WALL PANEL DESIGN CAPACITIES

Bracing Method	Baseline capacity (PLF)	Partial Restraint/System Effects Factor	IRC Lateral Design Capacity (PLF)[a]
LIB, GWB	400	1.2	480
DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB	700	1.2	840
CS-WSP, CS-G, CS-PF	820	1.2	985

a. The lateral design capacity of braced wall panels is based on fully restrained wall assembly tests (with holddowns) further adjusted by the partial restraint/systems effect factor.

Reason: Over the past several years, SBCRI has conducted a great deal of research into the requirements of the IRC, section R602.10 and the design capacity of wall assemblies built to those provisions. Table R602.10.3(1), Bracing Requirements Based on Wind Speed, was developed by the Ad-Hoc Wall Bracing Committee. The Lateral Design Capacity shown in the table above is the capacity determined by the committee to be used as the nominal strength of braced wall panels built to the minimum requirements of the IRC. The committee used as the basis for these design values, wall assembly test data from testing in accordance with ASTM E72, E564 or E2126. The braced wall panel lengths shown in Table R602.10.3(1) were calculated using these capacities. Table R602.10.4.4 simply adds design value transparency to this section by showing clearly what the assumed design capacity of braced wall panels is. This approach is intended to be an aid to all registered design professionals as they make decisions about how best to resist applied loads and the safety considerations thereof. The technical background on how the IRC wall bracing provisions were derived can be found in an article by Crandell-Martin in the spring 2009 edition of Wood Design Focus, " The Story Behind the 2009 IRC Wall Bracing Provisions (Part 2: New Wind Bracing Requirements)" Further research in this area by SBCRI can be found at http://sbcri.info/bwpex.php and additional background on current design values is found here http://sbcri.info/bcters.php

Cost Impact: This proposal will not increase the cost of construction.

RB309-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.4.4 (NEW)-RB-WAINRIGHT.doc

RB310 – 13
Table R602.10.5

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS

METHOD (See Table R602.10.4)		MINIMUM LENGTH[a] (in.) WALL HEIGHT 8 ft	9 ft	10 ft	11 ft	12 ft	CONTRIBUTING LENGTH (in.)
CS-PF	SDC A, B and C	16	18	20	22[e]	24[e]	1.5 x Actual[b]
	SDC D_0, D_1 and D_2	16	18	20	22[e]	24[e]	Actual[b]

(Portions of Table not shown remain unchanged)

Reason: Currently Method PFG (Portal Frame at Garage) is permitted in the 2012 IRC Table R602.10.5 with a 1.5 multiplier to convert the leg length to a length contributing to bracing. The multiplier was permitted because Method PFG was restricted for use in areas of low seismicity (SDCs A, B and C).

Cyclic testing conducted at APA in 2006 of the CS-PF (Continuous Sheathed – Portal Frame) showed that the CS-PF has a design strength at least as high as the PFG tested in a similar manner. Based on the results of this testing it is reasonable to permit the same multiplier to be applied to the Method CS-PF when similarly restricted to areas of low seismicity as is Method PFG.

Please note that the CS-PF portal frame can have a leg length as small at 16 inches, where the PFG has a minimum leg length of 24 inches. What makes the CS-PF perform as well or better than the PFG, even with a shorter leg length, is the fact that the CS-PF has nearly twice as many fasteners as the PFG. It is the fastener interaction between the framing and sheathing that determine the ultimate capacity of this wood-structural-panel/framing bracing system.

Note that the IRC bracing provisions are difficult to meet in many cases as a result of narrow building lots and the aesthetic requirements of modern homes. Areas around garages and picture windows are especially difficult to accommodate and still meet the minimum bracing requirements of the code. Permitting the equal-to-stronger minimum 16-inch CS-PF the same multiplier as the 24-inch PFG is both rational and extremely helpful in making the 2012 IRC bracing provisions viable.

We ask the committee to extend the same multiplier to the 16-inch CS-PF that is applied to the 24-inch PFG when the same use restrictions are applied. This is based on full-scale cyclic load tests described in APA Test Report T2006-29 and NAHB-Research Center Test Report EG5522_08216.

Cost Impact: The code change proposal will not increase the cost of construction.

RB310-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.5T-RB-KEITH.doc

RB311 – 13
Figure R602.10.6.2

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

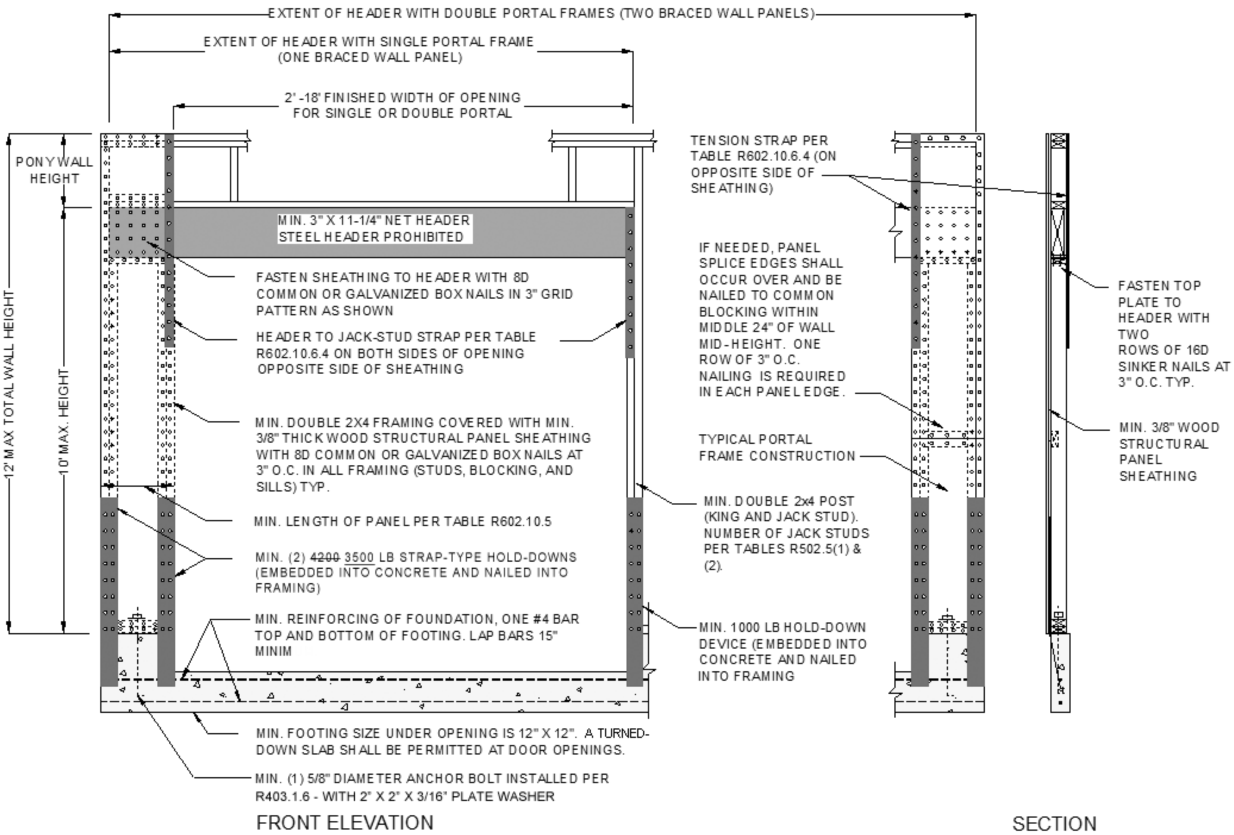


FIGURE R602.10.6.2
METHOD PFH-PORTAL FRAME WITH HOLD-DOWNS

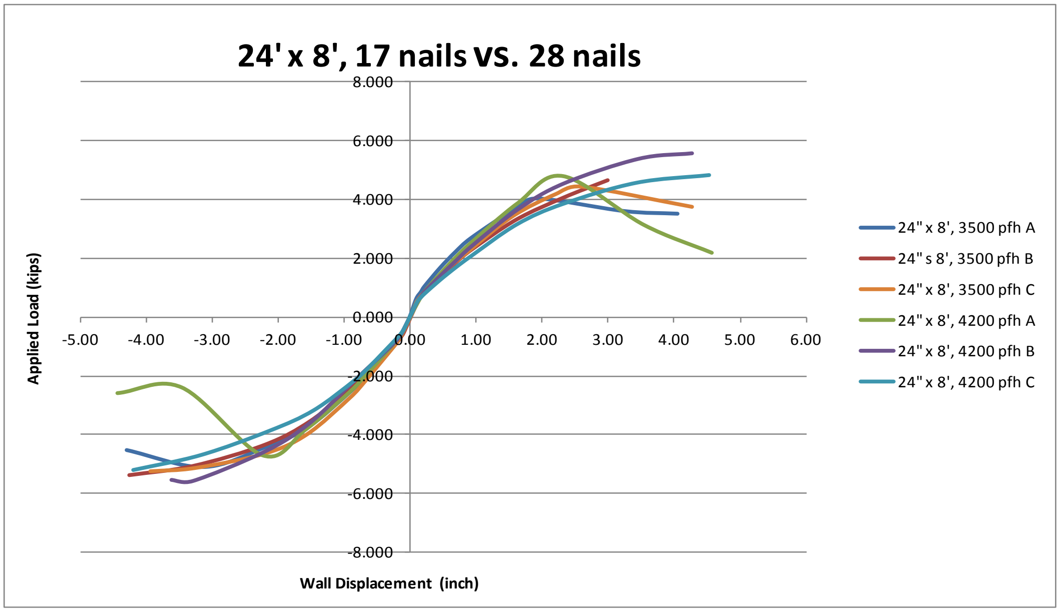
Reason: This is a companion item to S291-12/13 adopted in Portland in the October Final Action Hearing.

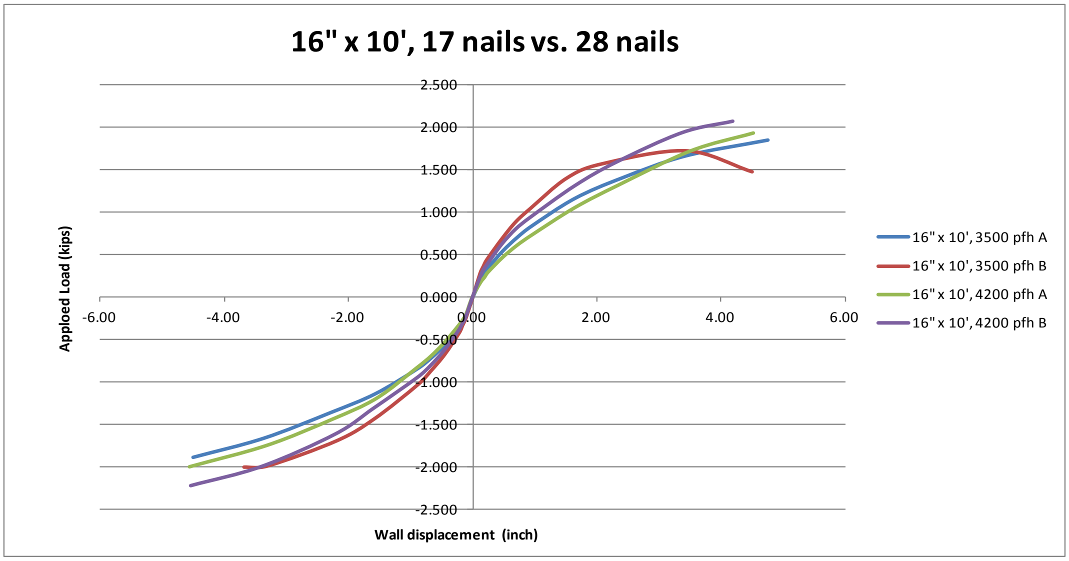
1) There are a couple of types of changes to Figure 2308.9.3.2 proposed. There are both technical changes and editorial changes.

Technical changes: The two technical changes made to the figure are the reduction of the capacity of the portal frame leg tie-down devices from 4200 lbf to 3500 lbf and the removal of the third bottom plate at the portal frame leg. (Note that the third bottom plate we propose to delete is NOT shown in the figure above. The normal strikethrough and underline procedures are difficult to apply to figure changes.)

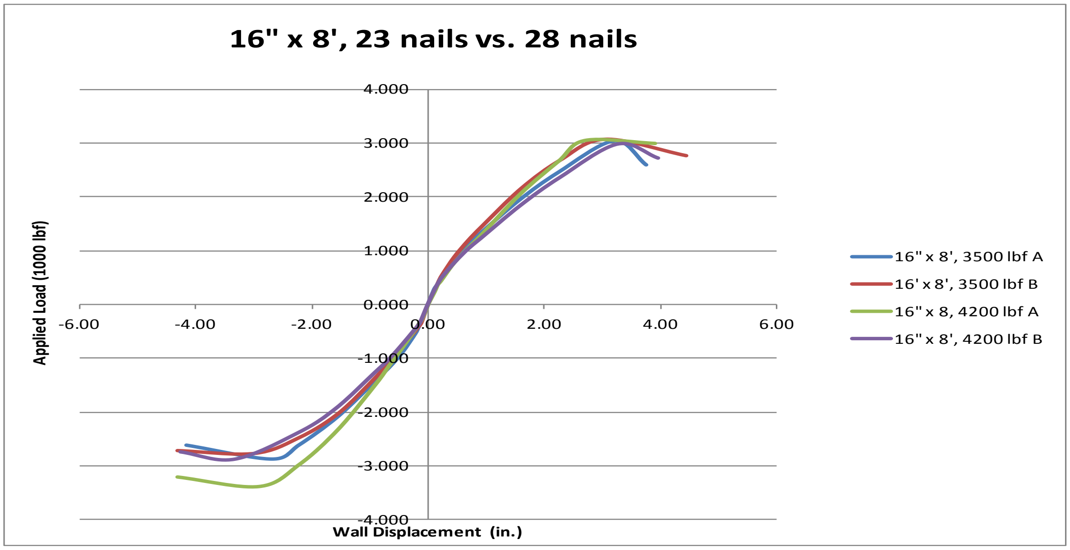
A. The first technical change is the reduction of the tie-down from 4200 lbf to 3500 lbf. The initial testing was conducted on the portal frames utilizing the 4200 lbf hold down because that was what was readily available and in common use by the construction industry. At the time of initial testing, no attempt was made to determine the sensitivity of the system to such a reduction in tie-down capacity. As the initial prescriptive parameters of the portal frame were based on testing, there was no latitude for determining the impact of the industry wide reduction to such tie-downs in response to the cracked-concrete provisions of ACI 318. As such, retesting of the portal frames with both 4200 lbf and 3500 lbf tie-downs was necessary to determine the impact on the performance of the system, if any. Portals with 24-inch wide legs x 8 foot height as well as 16-inch wide x 10 feet high were tested by APA. Pairs of each size were tested with 4200 lbf tie-downs and then retested with 3500 lbf tie-downs. Upon consultation with Simpson Strong-Tie technical personnel it was determined that the 3500 lbf capacity would be simulated by using 17 nails in the 4,200 lb strap. The 4,200 lb capacity of the strap was achieved by filling all 28 holes in the strap even though 21 nails would yield the 4,200 lbf capacities. This was done to simulate actual field installed conditions. The results of these tests as seen below illustrate that the whole portal frame system was relatively insensitive to the reduction in tie-down capacity within the over-nailed 4200 lbf to 3500 lbf range. No attempt was made to determine how low the tie-down capacity could be reduced before an impact on the performance of the portal frames could be seen.

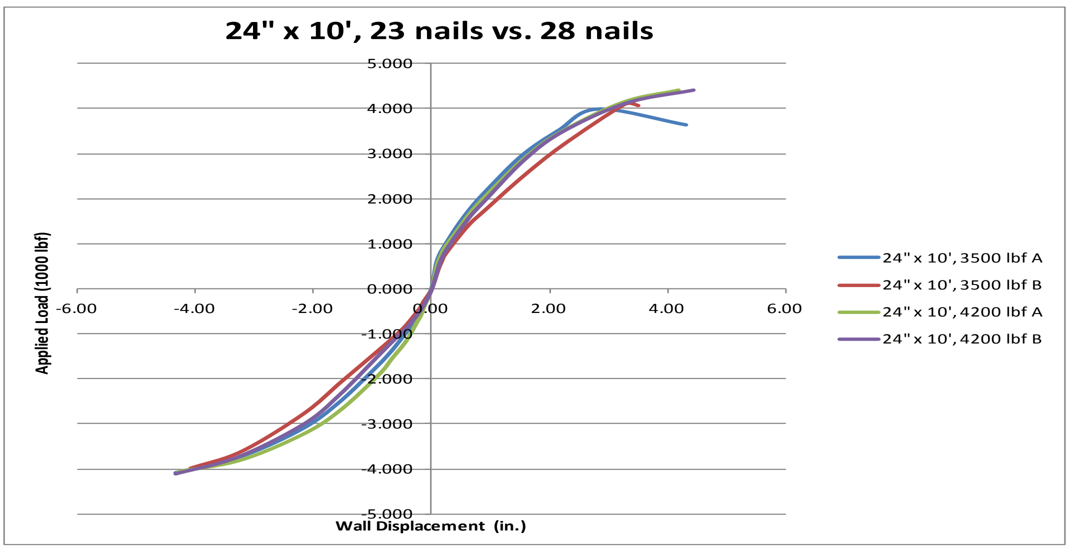
These tests were conducted using the CUREe method, as described in ASTM E2126, with a frequency of 0.5 Hz. The following charts show the backbone curves for the Method PFH portal frames tested with 3500 lbf and 4200 lbf tie-downs at both the 24-inch wide leg portals 8-feet high as well as the 16-inch wide portals 10-feet high. These are the extremes of the possible portal frame geometries from the most rigid (24-inch wide leg portals 8-feet high) to the least rigid (16-inch wide portals 10-feet high).





The results of the above tests agree favorably with previous testing conducted with varying numbers of fasteners as seen below:





B. The second technical change is the removal of the third bottom plate. The attached figure shows the third bottom plate removed from the figure. As mentioned above the original testing was conducted with the third plate in place. The third plate causes numerous difficulties in the field, not the least of which is that the normal length threaded anchors are too short to accommodate the third plate and provide the required depth of penetration into the foundation. This results in inadequate anchor depth-of-embedment or the use of threaded sleeves and all-thread to extend the bolt length to accommodate the third plate. When investigating the change to the 3500 lbf hold down, we utilized this opportunity to run the tests with only double bottom plates. All subsequent testing was done without the third bottom plate. The results of this testing indicated that the third bottom plate has negligible impact on the performance of the portal frames.

It is clear from the backbone curves shown above that the reduction in the capacity of the hold-down strap from 4,200 to 3,500 lbf has no significant impact on the performance of the portal frame. As such, we request that by this public comment, the reference to the hold-down capacity be changed from 4,200 to 3,500 lbf in both the figure and corresponding text.

APA Report T2012L-24 – *Bracing Method Alternative Attachment (IBC), Portal Frame with Hold Downs (Bracing Method PFH) (IRC) – Hold-Down Strap Capacity Variations* is available for free download at apawood.org.

Cost Impact: The code change proposal will not increase the cost of construction.

RB311-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.6.2F #1-RB-KEITH.doc

RB312 – 13

Figure R602.10.6.2, Figure R602.10.6.3, Figure R602.10.6.4

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

In all three of the figures revise the following annotation directed to the mid-height splice of the portal frame legs.

IF NEEDED, PANEL SPLICE EDGES SHALL OCCUR OVER AND BE NAILED TO COMMON BLOCKING WITHIN THE MIDDLE 24" OF THE ~~WALL MID-~~PORTAL-LEG HEIGHT. ONE ROW OF 3" O.C. NAILING IS REQUIRED IN EACH PANEL EDGE.

Reason: The original intent of the annotation was to place the permissible splice location within a band 24-inches wide located at the center of the portal-frame leg. Due to an unfortunate choice of language in the original development of these two drawings, the stipulation for "within 24" of the wall mid-height" describes a band that is 48-inches wide (24 inches from above to mid-height and 24 inches from below to mid-height. Such an interpretation is far outside of the original intent.

This proposal also changes "wall mid-height" to "portal-leg height". In the original development of this method the portal-leg height was only different from the wall height by the width of the header so while the original language was not correct (it is the portal-leg height that is important when making the panel splice), a miss-interpretation was not significant. Recent changes to the IRC, however, permit the possibility of placing pony walls over the portals, and/or placing the portals on masonry stem-walls. As the difference between the portal-leg height and the wall height can now be up to 48 inches it is very important properly state the appropriate location for the sheathing splice plate. The center 24 inches of the *portal leg* is the appropriate place for the splice. Request the committee's approval to clarify the true intent of these provisions.

Note that with approval of this proposal the same annotation will be used in all three of the portal frame figures in the IRC, minimizing confusion and reducing the possibility of misapplication.

Cost Impact: The code change proposal will not increase the cost of construction.

RB312-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.6.2F #2-RB-KEITH.doc

RB313 – 13
Figure R602.10.6.2, Figure R602.10.6.3, Figure R602.10.6.4

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

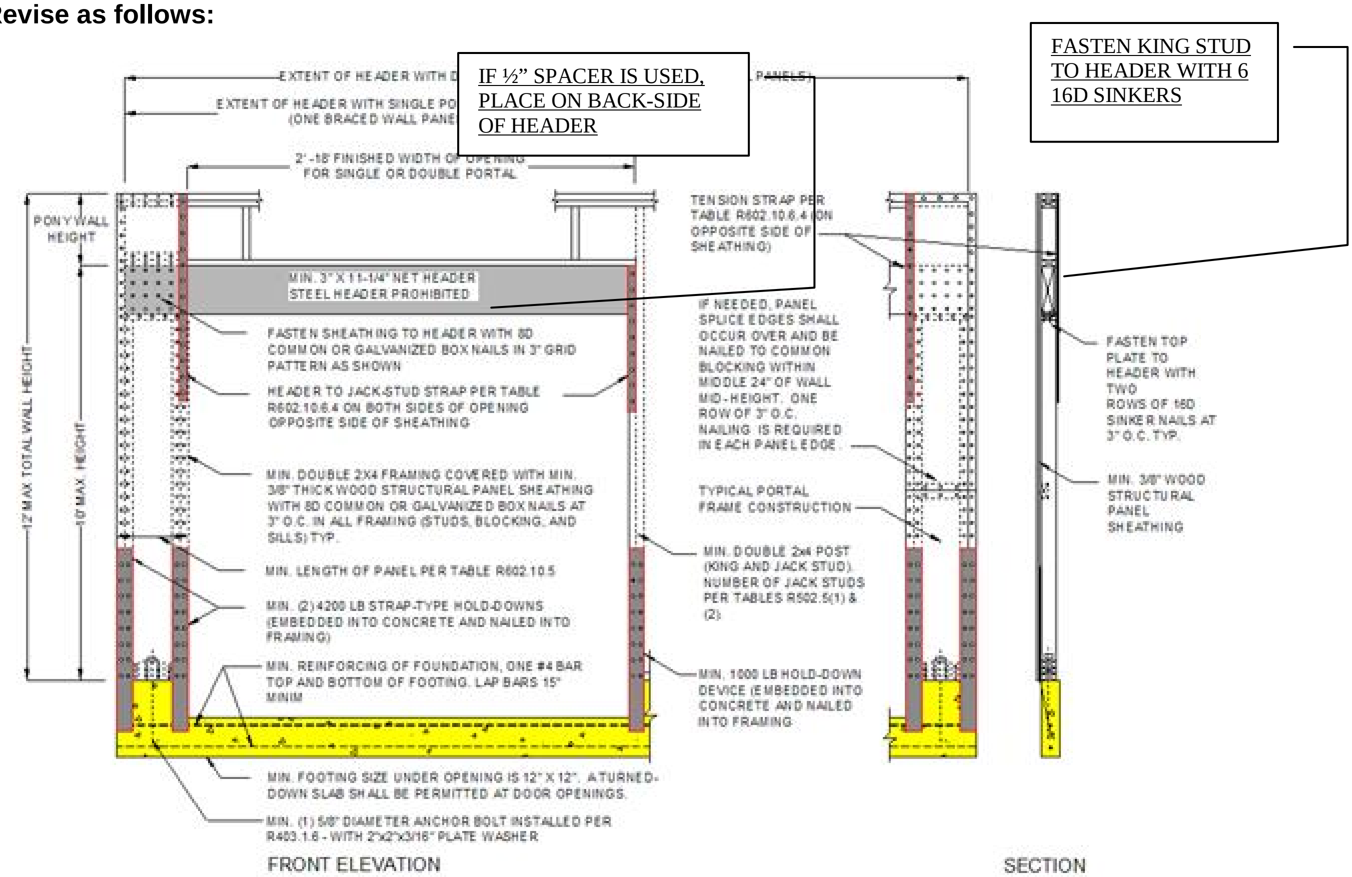


FIGURE R602.10.2
METHOD PFH: PORTAL FRAME WITH HOLD-DOWNS

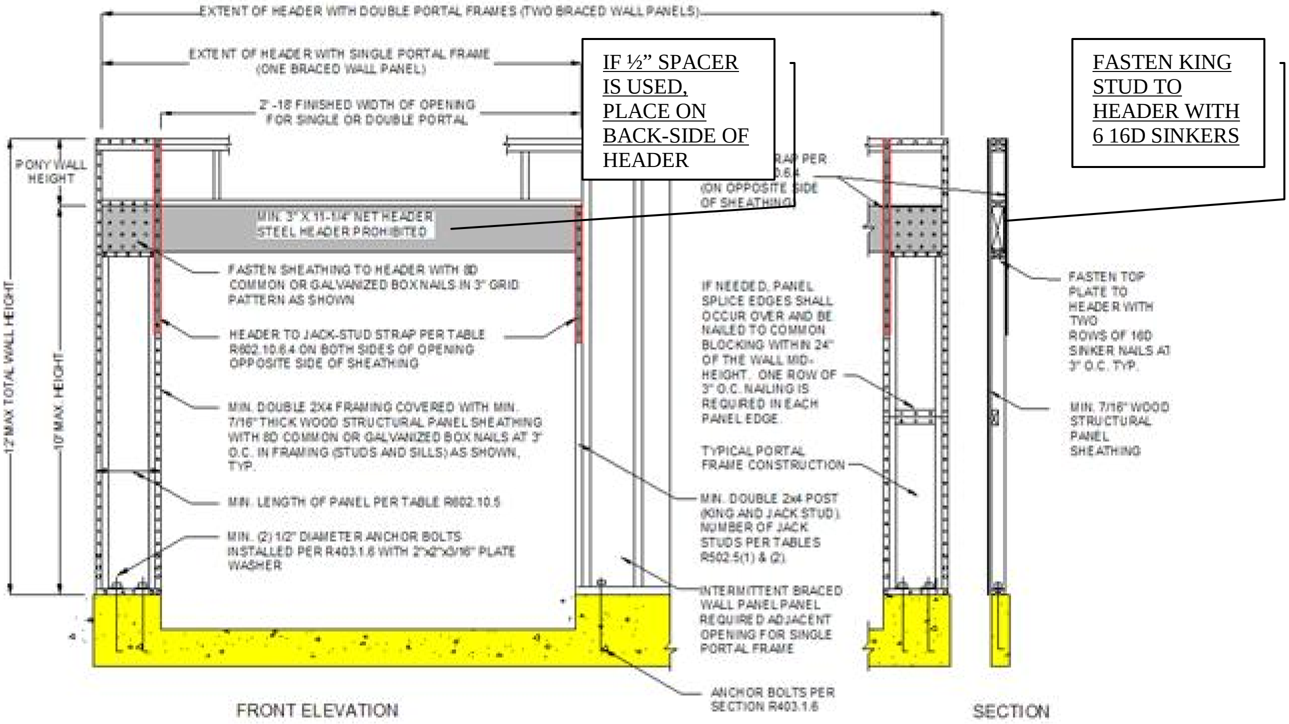


FIGURE R602.10.6.3
METHOD PFG: PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B, AND C

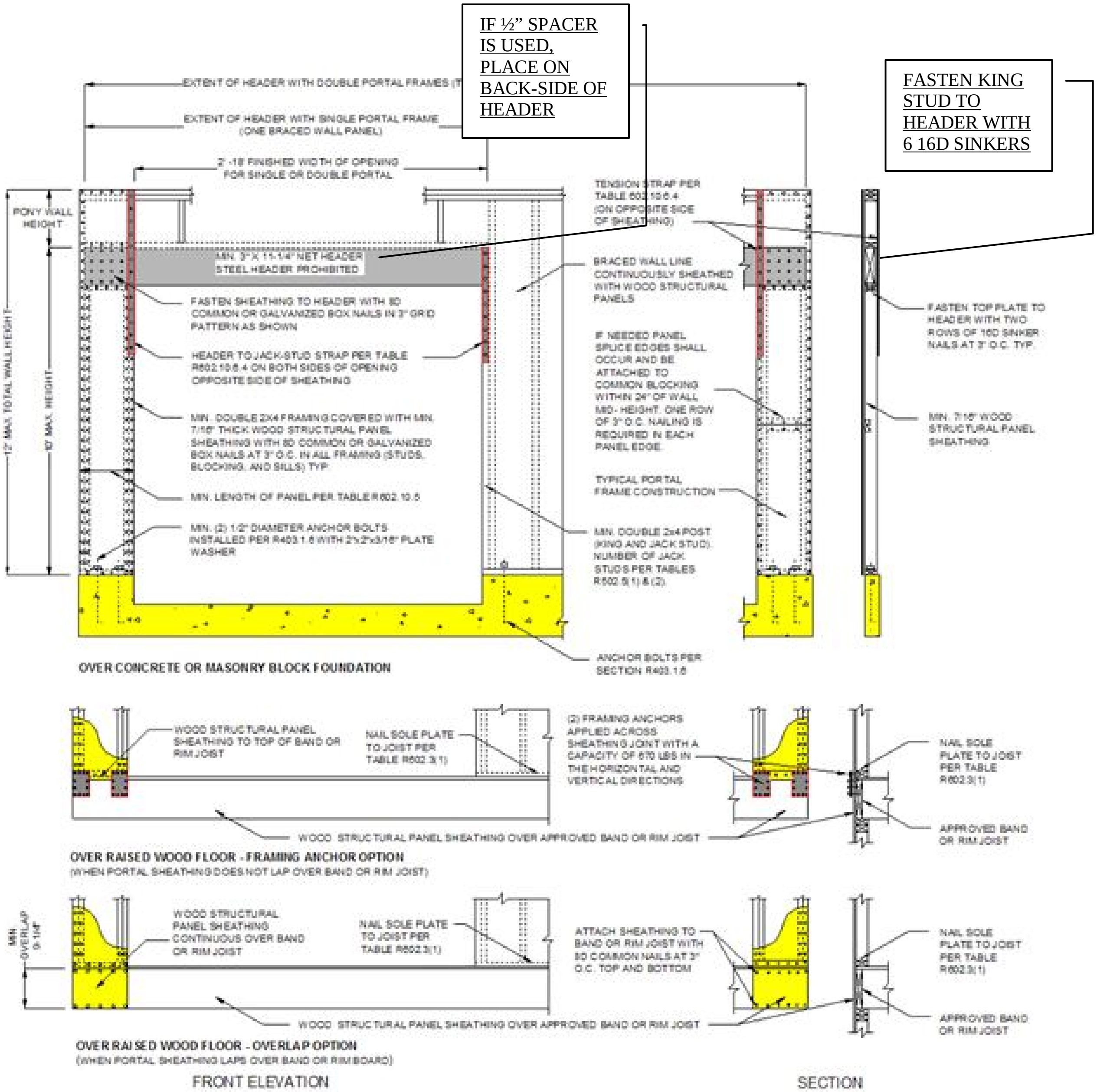


FIGURE R602.10.6.4
METHOD CS-PH; CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

Reason: When the three portal frame figures were homogenized and redrawn by a single source for the 2009 IRC a couple of annotations were inadvertently eliminated from the drawings. The attached proposal replaces these annotations.

The first annotation in all 3 figures states that is a ½-inch spacer is used to develop a built-up header, that the spacer be put on the back-side of the header. This placement insures that the 8d nails used in the grid pattern at the top of the portal leg adequately penetrate the back header to insure proper load distribution. As the spacer offers no structural advantage to the header, its placement behind the built-up header is of no structural consequence.

The second annotation calls out 6 16d sinker nails to attach the king stud to the header at the top of the portal-frame leg. These assemblies were developed and tested with these nails present and this should be reflected in the drawings.

We encourage the committee to vote in favor of this proposal to clarify the intent of these 3 portal-frame figures.

Cost Impact: The code change proposal will not increase the cost of construction.

RB313-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.6.2F #3-RB-KEITH.doc

RB314 – 13
Table R602.10.3(4), R602.10.6.5

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

d. Applies to stone or masonry veneer exceeding the first story height or extending up into the gable end. See Section R602.10.5 for requirements when stone or masonry veneer does not exceed the first story height and does not extend up into the gable end.

(Portions of Table not shown remain unchanged)

R602.10.6.5 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D_0, D_1 and D_2. Where stone and masonry veneer are installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines* and *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supporting veneered walls shall comply with this section.

Where dwellings in Seismic Design Categories D_0, D_1 and D_2 have stone or masonry veneer installed in accordance with Section R703.7, and the veneer does not exceed the first-story height and does not extend up into the gable end, wall bracing shall be in accordance with Section R602.10.3.

Where detached one- or two-family dwellings in Seismic Design Categories D_0, D_1 and D_2 have stone or masonry veneer installed in accordance with Section R703.7, and the veneer exceeds the first-*story height* or extends up into the gable end, wall bracing at exterior *braced wall lines* and *braced wall lines* on the interior of the building shall be constructed using Method BV-WSP in accordance with this section and Figure R602.10.6.5. Cripple walls shall not be permitted, and required interior *braced wall lines* shall be supported on continuous foundations.

Townhouses in Seismic Design Categories D_0, D_1 and D_2 with stone or masonry veneer exceeding the first-story height or extending up into the gable end shall be designed in accordance with accepted engineering practice.

Reason: The IRC is clear that the line of demarcation between using the standard bracing provisions and the Method BV-WSP is when the brick or masonry veneer extends up past the first story height. It is not clear what to do when the veneer extends up the gable-end wall. The definition of story in Chapter 2 provided below could lead one to believe that the gable–end wall was part of the story below:

STORY. *That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.*

From a structural perspective, however the mass in a gable end wall can equal or exceed the mass of a veneered second story. For example a 40-foot wide building with a 12:12 pitch can have gable-end wall that is a maximum of 20 feet tall above the top of the wall below. As the area is triangular the average height of this gable-end wall is 10 feet tall. This is the same mass as a veneered 10 foot second story wall.

It is clearly NOT the intent of the IRC to permit the standard bracing provisions for only a single story UNLESS the same or larger mass is part of a gable-end wall. The above proposal clarifies the intent of this section with respect to veneered gable-end walls.

Cost Impact: The code change proposal will not increase the cost of construction.

RB314-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.6.5-RB-KEITH.doc

RB315 – 13
R602.10.6.5.1

Proponent: Randall Shackelford, P.E., Simpson Strong-Tie Co., Inc. (rshackelford@strongtie.com)

Revise as follows:

R602.10.6.5.1 Length of bracing. The length of bracing along each *braced wall line* shall be the greater of that required by the design wind speed and *braced wall line* spacing in accordance with Table R602.10.3(1) as adjusted by the factors in the Table R602.10.3(2) or the Seismic Design Category and *braced wall line* length in accordance with Table R602.10.6.5. Angled walls shall be permitted to be counted in accordance with Section R602.10.1.4, and *braced wall panel* location shall be in accordance with Section R602.10.2.2. <u>Spacing between *braced wall lines* shall be in accordance with Table R602.10.1.3.</u> The seismic adjustment factors in Table R602.10.3(4) shall not be applied to the length of bracing determined using Table R602.10.6.5<u>, except that the bracing amount increase for *braced wall line* spacing greater than 25 feet in accordance with Table R602.10.1.3 shall be required.</u> In no case shall the minimum total length of bracing in a *braced wall line*, after all adjustments have been taken, be less than 48 inches (1219 mm) total.

Reason: The purpose is this code change is to clarify the required maximum spacing of braced wall lines supporting brick veneer in Seismic Design Categories D_0, D_1, and D_2, and when the spacing is permitted to be increased, and that the bracing amounts are to be increased when the braced wall spacing is increased above the typical maximum of 25 feet. The current section is basically silent on what the braced wall line spacing should be. Further, it states that the typical seismic increases in Table R602.10.3.4 are not to be used. This could lead the user to believe that all braced wall lines must be spaced a maximum of 25 feet apart. By specifying that the braced wall line spacing is to be in accordance with Table R602.10.1.3, this clarifies that the spacing is permitted to be increased to 35 feet in certain cases.
But when braced wall line spacing is increased, the shear load on the braced wall lines is increased, so more bracing is required. This change will allow for flexibility in residences that are covered by this section by clarifying that the braced wall lines are permitted to be spaced up to 35 feet apart, as long as the amount of bracing is appropriately increased.

Cost Impact: Depending on how this section is currently being interpreted, this could lower costs by allowing braced wall lines to be spaced farther apart, or it could increase costs if braced wall lines are currently being permitted to be spaced further apart than allowed by Table R602.10.1.3.

RB315-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

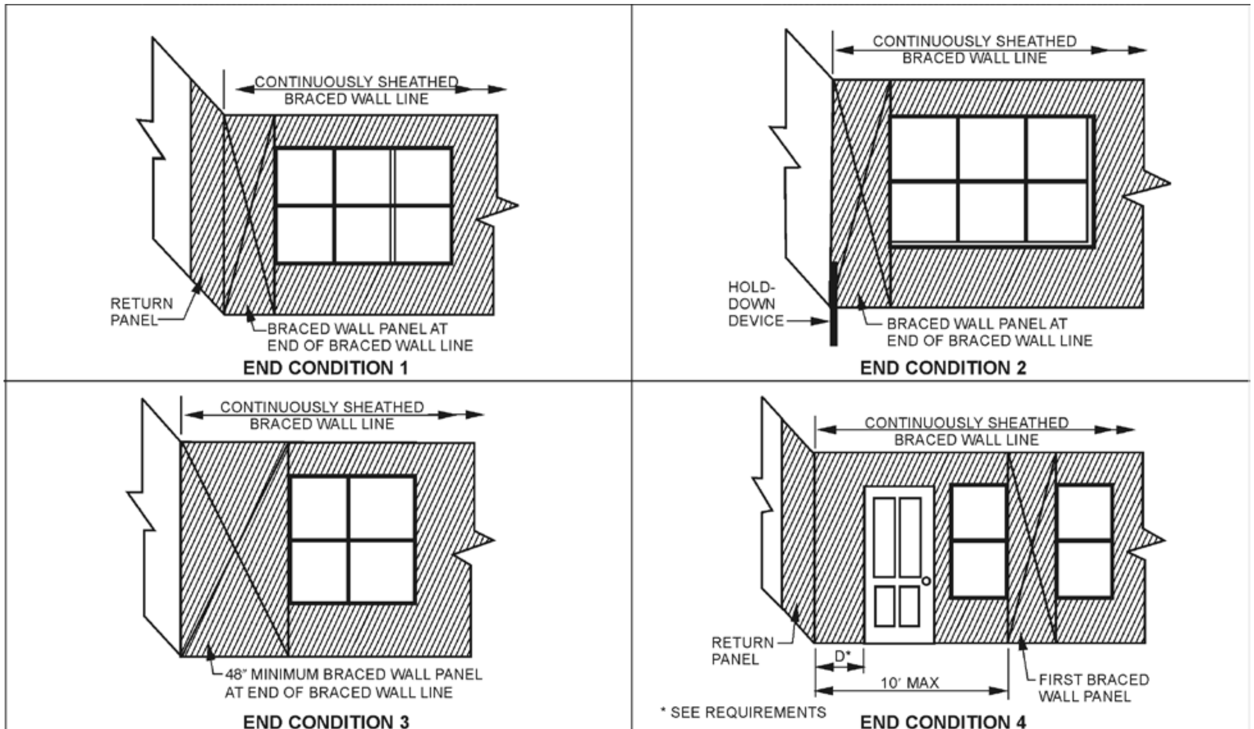
R602.10.6.5.1-RB-SHACKELFORD.doc

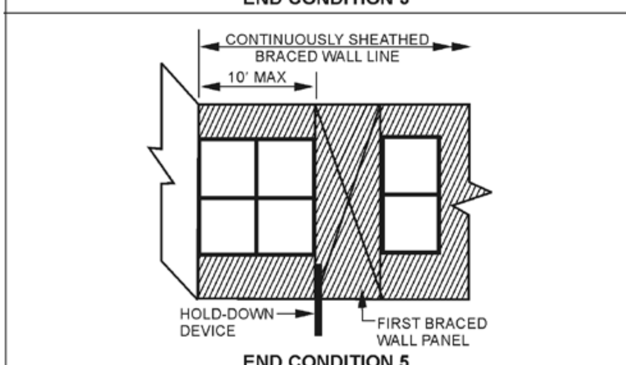
RB316 – 13
Figure R602.10.7

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing, National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES ~~WITH CONTINUOUS SHEATHING~~





REQUIREMENTS

Return panel:	24″ for braced wall lines sheathed with wood structural panels 32″ for braced wall lines sheathed with structural fiberboard
Distance D:	24″ for braced wall lines sheathed with wood structural panels 32″ for braced wall lines sheathed with structural fiberboard
Hold-down device:	800 lbs capacity fastened to the edge of the braced wall panel closest to the corner and to the foundation or floor framing below

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.45 N.

Reason: Figure R602.10.7 shows when an end restraint is required for the methods covered in R602.10.7 and not just for the Continuously Sheathed Method.

Cost Impact: This code change proposal will not increase construction cost.

RB316-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.7F #1-RB-MLAKAR-MOORE.doc

RB317 – 13
Figure R602.10.7

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

REQUIREMENTS	
Return panel:	24” for braced wall lines sheathed with wood structural panels 32” for braced wall lines sheathed with structural fiberboard
Distance D:	24” for braced wall lines sheathed with wood structural panels 32” for braced wall lines sheathed with structural fiberboard
<u>**Return panel anchorage:**</u>	<u>Provide 5/8” anchor with 3”x3” bearing washer 12” maximum from corner of return wall</u>
Hold-down device:	800 lbs. capacity fastened to the edge of the braced wall panel closest to the corner and to the foundation or floor framing below

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

(Portions of Figure not shown remain unchanged)

Reason: Current return panel requirement does not require anchorage for the return panel that reflects the tested condition. This proposal adds limitation and anchorage requirement to return panel.

<u>**Reference**</u>

1) J.D. Dolan and C.P. Heine, 1997 “Sequential Phased Displacement Tests of Wood-frame Shear Walls with Corners,” Report No. TE-1997-003, Brooks Forest Products Research Center, VPI&SU, Blacksburg, VA. September 14, 1997.

Cost Impact: This code change proposal will not increase construction cost.

RB317-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.7F #2-RB-MLAKAR-MOORE.doc

RB318 – 13
Figure R602.10.7

Proponent: Kevin S. Moore, S.E., Chair of Seismic Subcommittee to Code Advisory Committee, representing National Council of Structural Engineers Associations (ksmoore@sgh.com); Matt Mlakar, Chair of General Engineering Committee, Structural Engineers Association of California

Revise as follows:

REQUIREMENTS	
Return panel:	24” for braced wall lines sheathed with wood structural panels 32” for braced wall lines sheathed with structural fiberboard
Distance D:	24” for braced wall lines sheathed with wood structural panels 32” for braced wall lines sheathed with structural fiberboard
Hold-down device:	800 lbs. capacity fastened to the edge of the braced wall panel closest to the corner and to the foundation or floor framing below
<u>**Return panel anchorage:**</u>	<u>Return panel not permitted for second floor unless designed in accordance with accepted engineering practice</u>

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

(Portions of Figure not shown remain unchanged)

Reason: This proposal adds a limitation and anchorage requirement to the return panel provision. Supporting experimental research utilized anchorage to a rigid base for return panel. The anchorage required at the second floor must be designed using accepted engineering practice. A substantiated load path detail from the second floor return panel to story below could be developed and provided in future editions of the IRC.

<u>**Reference**</u>

1) J.D. Dolan and C.P. Heine, 1997 “Sequential Phased Displacement Tests of Wood-frame Shear Walls with Corners,” Report No. TE-1997-003, Brooks Forest Products Research Center, VPI&SU, Blacksburg, VA. September 14, 1997.

Cost Impact: This code change proposal will not increase construction cost.

RB318-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.7F #3-RB-MLAKAR-MOORE.doc

RB319 – 13
R602.10.8.2

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim, or header joist or roof truss parallel to the braced wall panels shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously-sheathed braced wall lines. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with Section R806.1.

1. For Seismic Design Categories A, B and C ~~and wind speeds less than 100 mph (45 m/s)~~ where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 9 1/4 inches (235 mm) or less, blocking between rafters or roof trusses shall not be required. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is between 9 1/4 inches (235 mm) and 15 1/4 inches (387 mm), blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).

   <u>**Exception:** Where the outside edge of truss vertical web members aligns with the outside face of the wall studs below, the wall sheathing extending above the top plate as shown in Figure R602.10.8/2(3) shall be permitted to be fastened to each truss webs with 3-8d nails (2.5" x 0.131") and blocking between the trusses shall not be required.</u>

2. For Seismic Design Categories D0, D1 and D2 ~~or wind speeds of 100 mph (45 m/s) or greater~~, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses is 15 1/4 inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).

3. Where the distance from the top of the braced wall panel to the top of rafters or roof trusses exceeds 15 1/4 inches (387 mm), the top plates of the braced wall panel shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:

   3.1. Soffit blocking panels constructed in accordance with Figure R602.10.8.2(2);

   3.2. Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3);

   3.3. <u>Blocking panels provided by the roof truss manufacturer and designed in accordance with Section R802.10</u>~~Full-height engineered blocking panels designed in accordance with the AF&PA WFCM~~; or

   3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with <u>the AWC WFCM or</u> accepted engineering practice.

Reason: In 2010, the NAHB Research Center with the support of NAHB and the Forest Products Laboratory conducted testing of roof assemblies with 10" and 16" deep truss heels. The research indicates that the IRC blocking provisions are overly conservative for truss heels up to 16" in areas within the wind design limits of the IRC. The results can be summarized and compared with required lateral capacities per Table 3.4 of the 2012 *Wood Frame Construction Manual*:

700-year Basic Wind Speed (mph)	Wind Exposure	Heel Height (inches)	Required Lateral Capacity (lbs)	Peak Lateral Capacity (lbs)	Factor of Safety	Deflection (inches)
140mph	B	10	134	514	3.84	0.40
140mph	B	10	134	332	2.62	0.60
140mph	C	16	186	514	2.76	0.55
140mph	C	16	186	332	1.89	0.80

The NAHBRC also tested several 16" heel configurations with a strip of OSB face-nailed to the ends of the trusses instead of blocking between the trusses. The peak capacities exceeded those for the unblocked 16" heel and were slightly lower than those for the 10" heel. The stiffnesses are greater than those for both the unblocked 10" and the 16'" heel, thus the deflections at the required lateral capacity will be less.

Two additional changes are proposed. The current options 3.3 and 3.4 for designing a blocking panel using the WFCM or designing blocking, blocking panels or other methods of lateral load transfer are effectively one and the same. The WFCM provides an engineered design, whether the Chapter 2 engineering tables or Chapter 3 prescriptive tables are used. It is therefore proposed to combine the option to use the WFCM into the general design option. A pointer to the wood truss section is added for when the truss manufacturer designs and supplies truss blocking panels as part of the truss package. By adding this pointer, the truss manufacturer is still required to design the truss block in accordance with accepted engineering practice, but the design need not be signed and sealed by a registered design professional unless the jurisdiction where the project is located requires the entire truss design package be signed and sealed.

Cost Impact: The code change proposal will not increase the cost of construction.

RB319-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.8.2-RB-EHRLICH.doc

RB320 – 13
R602.10.8.2(3)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

Add detail as shown below to Figure R602.10.8.2(3): (Remainder unchanged)

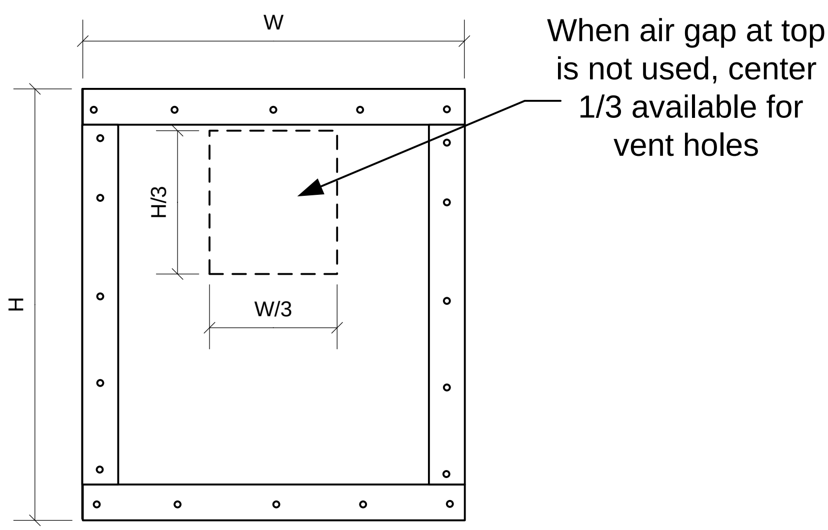


FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

Reason: When the air gap is not desired, as in the case of an engineered roof system, the ventilation requirements can be met by placing an opening in the fabricated blocking panels. An opening sized as shown above will not compromise the ability of the fabricated blocking panel to resist overturning or transfer shear from the roof diaphragm to the wall below.

Cost Impact: The code change proposal will not increase the cost of construction.

RB320-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.8.2(3)F-RB-KEITH.doc

RB321 – 13
R602.10.11

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.10.11 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Tables R602.10.3(2) and R602.10.3(4), respectively, except the length of the cripple wall bracing shall be multiplied by a factor of 1.15. The maximum distance between adjacent edges of braced wall panels shall be reduced from 20 feet (6069 mm) to 14 feet (4267 mm). When gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase described above.

Reason: The original provision requires the cripple wall length of bracing to be based on the length of bracing used in the wall above the cripple wall, increased by a factor of 1.15. Note however, the walls above are normally habitable spaces and as such the lengths of bracing used in these spaces are usually based on using gypsum board on the inside of the walls. Cripple walls however are not normally fabricated with a gypsum wall board finish on the inside. As such, just to make the resistance to wind or seismic forces equal between the walls above and the cripple walls below, the required bracing lengths in the cripple walls below would have to be increased by the adjustment factors (1.4 for wind and 1.5 for seismic) applicable when gypsum board is not present on the inside. See Tables R602.10.3(2) and (4). Of course, the alternative would be to sheath the inside of the cripple wall framing with gypsum wall board or an equivalent finish. On top of this increase in bracing of the cripple walls by either applying the adjustment factors or through the application of gypsum wallboard to the inside of the cripple wall framing, the 1.15 is still applicable.

Note that the 1.15 increase for cripple walls was a part of the code before the wall bracing lengths were based on gypsum board, or an equivalent, being required on the inside of the braced wall panels. As such it is clearly the intent of the code that the cripple walls have 15 percent more resistance to wind and seismic forces (a greater length of bracing) than the walls it supports. To accomplish this, cripple wall bracing length must be increased if gypsum wall board is not installed on the inside in addition to the 1.15 factor.

Cost Impact: The code change proposal will not increase the cost of construction.

RB321-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.11-RB-KEITH.doc

RB322 – 13
R602.10.11

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R602.10.11 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. ~~The distance between adjacent edges of *braced wall panels* shall be reduced from 20 feet (6096 mm) to 14 feet (4267 mm).~~

Reason: The purpose of this code change proposal is to correct an error made in correlating the 2012 braced wall provisions. The reduction in spacing between braced wall panels in a cripple wall originated from cripple wall failures observed in seismic events such as the 1994 Northridge Earthquake. Working through the ICC Ad-Hoc Committee on Wall Bracing, NAHB developed a proposal for the 2009/2010 Code Development Cycle that reorganized the cripple wall bracing provisions and removed the spacing reduction for low-seismic areas. The proposal was approved at the Public Hearings and ratified by the consent agenda vote at the Final Action Hearings. A separate effort by the Ad-Hoc Committee to correlate their comprehensive reorganization of the wall bracing section with a modification made by the IRC-Building/Energy Committee inadvertently resulted in the spacing reduction being reinstated for low-seismic areas. This amendment corrects that oversight and restores the original intent of the Ad-Hoc Wall Bracing Committee's cripple wall proposal.

Cost Impact: The code change proposal will not increase the cost of construction.

RB322-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10.11-RB-EHRLICH.doc

RB323 – 13
R602.12, Table R602.12.4

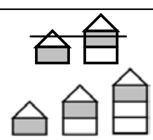
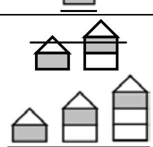
Proponent: Brian Foley, P.E., Fairfax County, VA representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov)

Revise as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than ~~two~~ three stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inches (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B..
7. The structure shall be located in Seismic Design Category of A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in ~~two~~three-story buildings.

TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

STORY LEVEL	EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b] Length of short side (ft) [c]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b] Length of long side (ft) [c]					
		10	20	30	40	50	60	10	20	30	40	50	60
	10	1	2	2	2	3	3	1	2	2	2	3	3
		2	3	3	4	5	6	2	3	3	4	5	6
		2	3	4	6	7	8	2	3	4	6	7	8
	15	1	2	3	3	4	4	1	2	3	3	4	4
		2	3	4	5	6	7	2	3	4	5	6	7
		2	4	5	6	7	9	2	4	5	6	7	9

For SI: 1 ft = 304.8 mm

a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.
c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

Reason: Using the existing adjustments for a three story building from Section R602.10, the use of Simplified Wall Bracing can be expanded to a wide range of buildings without impacting safety. Since the values in Table R602.12.4 were calculated from R602.10, then the adjustment factors will create an accurate bracing amount for a three-story building just as it would if calculated from the wind tables of R602.10.

Cost Impact: The code change proposal will not increase the cost of construction.

RB323-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12 #2-RB-FOLEY.doc

RB324 – 13
R602.12, Table R602.12.4

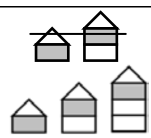
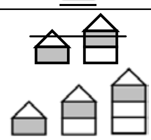
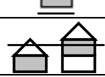
Proponent: Brian Foley, P.E., Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov)

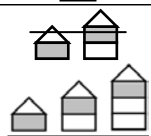
Revise as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than ~~two~~ three stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All exterior walls shall have gypsum board with a minimum thickness of $^{1}/_{2}$ inches (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the basic wind speed is less than or equal to ~~90~~ 100 mph (~~40~~ 44 m/s), and the Exposure Category is A or B.
7. The structure shall be located in Seismic Design Category of A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in ~~two~~three-story buildings.

TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

WIND SPEED	STORY LEVEL	EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b]					
			Length of short side (ft) [c]						Length of long side (ft) [c]					
			10	20	30	40	50	60	10	20	30	40	50	60
90		10	1	2	2	2	3	3	1	2	2	2	3	3
			2	3	3	4	5	6	2	3	3	4	5	6
			2	3	4	6	7	8	2	3	4	6	7	8
		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9
100		10	1	2	2	3	3	4	1	2	2	3	3	4

WIND SPEED	STORY LEVEL	EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b]					
			Length of short side (ft) [c]						Length of long side (ft) [c]					
			10	20	30	40	50	60	10	20	30	40	50	60
														
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	7	8	10	2	4	5	7	8	10
			2	3	3	4	4	6	2	3	3	4	4	6
		15	3	4	6	7	8	10	3	4	6	7	8	10
			3	6	7	10	11	13	3	6	7	10	11	13

For SI: 1 ft = 304.8 mm

a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.

c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

Reason: Using the wall bracing values for wind speed of 100 mph and three stories from Section R602.10, the use of Simplified Wall Bracing can be expanded to a wide range of areas and building types without impacting safety. Since the 90 mph values in Table R602.12.4 were calculated from R602.10, then the 100 mph will create an accurate bracing amounts as it would if calculated from the wind tables of R602.10.

Cost Impact: The code change proposal will not increase the cost of construction.

RB324-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12 #3-RB-FOLEY.doc

RB325 – 13
R602.12, Table R602.12.4

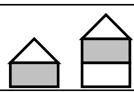
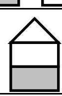
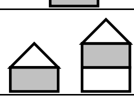
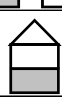
Proponent: Brian Foley, P.E., Fairfax County, VA, representing Virginia Building and Code Officials Association (brian.foley@fairfaxcounty.gov)

Revise as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inches (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A~~,~~ ~~or~~ B or C.
7. The structure shall be located in Seismic Design Category of A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in two-story buildings.

TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

STORY LEVEL	EAVE-TO RIDGE HEIGHT (FEET)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b,d]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b,d]					
		Length of short side (ft) [c]						Length of long side (ft) [c]					
		10	20	30	40	50	60	10	20	30	40	50	60
	10	1	2	2	2	3	3	1	2	2	2	3	3
		2	3	3	4	5	6	2	3	3	4	5	6
	15	1	2	3	3	4	4	1	2	3	3	4	4
		2	3	4	5	6	7	2	3	4	5	6	7

For SI: 1 ft = 304.8 mm

a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.

c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

d. For exposure category C, multiply bracing units by a factor of 1.20 for a one-story building and 1.30 for a two-story building.

Reason: Using the existing adjustments for exposure category C from Section R602.10, the use of Simplified Wall Bracing can be expanded to a wide range of areas of the country without impacting safety. Since the values in Table R602.12.4 were calculated from R602.10, then the adjustment factors will create an accurate bracing amount for exposure category C just as it would if calculated from the wind tables of R602.10.

Cost Impact: The code change proposal will not increase the cost of construction.

RB325-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12 #1-RB-FOLEY.doc

RB326 – 13
R602.12, Table R602.12.4

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.12 Simplified wall bracing. Buildings meeting all of the conditions listed in items 1-8 shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall.Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All exterior walls shall have gypsum board with a minimum thickness of $^1/_2$ inch (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.
6. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B <u>except as provided for in Table R602.12.4, footnote d.</u>.
7. The structure shall be located in Seismic Design Category A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in two-story buildings.

TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE

STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE [a,b,<u>d</u>]						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE [a,b,<u>d</u>]					
		Length of short side (feet)[c]						Length of long side (feet)[c]					
		10	20	30	40	50	60	10	20	30	40	50	60

<u>d. The simplified wall bracing method (Section R602.12) shall be permitted to be used in wind Exposure Category C providing the minimum number of bracing units shown in Table R602.10.4 above is multiplied by a factor of 1.2 for a single-story building and by a factor of 1.3 for a two-story building, and the result shall be rounded to the next higher unit.</u>

(Portions of Table not shown remain unchanged)

Reason: A great part of the Midwest meets the wind-speed requirements of the simplified method but because the Great Plains is designated Exposure C. For the purposes of the Simplified Bracing Method, the primary difference between the bracing required in Exposure B and C is that Exposure C requires additional bracing. A review of the permitted narrow wall bracing methods shows that all are appropriate for Exposure Categories A-C. The required 3/8 inch WSP is appropriate for 90 miles per hour Exposure C as well (Table R602.3(3)). And, in accordance with Footnote d of Table R602.10.4, structural fiberboard sheathing thickness may also be used in any exposure up to 100 mph.

As nothing else in the Simplified Bracing Method limits it to Exposure B except the amount of bracing required, the wind exposure adjustment factors in Table R602.10.3(2) are appropriate for increasing the amount of bracing needed to expand the use of the method to Exposure C. Note that these adjustment factors have been a part of the code for over 6 years.

Cost Impact: The code change proposal will not increase the cost of construction.

RB326-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12-RB-KEITH.doc

RB327 – 13
R602.12.6.2

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.12.6.2 Method CS-PF *Braced wall panels* constructed as Method CS-PF in accordance with Section R602.10.6.4 shall be permitted when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal ~~0.5~~ 0.75 bracing units. A maximum of four CS-PF panels shall be permitted on all segments of walls parallel to each side of the circumscribed rectangle. Segments of walls which include a Method CS-PF panel shall meet the requirements of Section R602.10.4.2.

Reason: Currently each Method PFG (Portal Frame at Garage) is permitted in the 2012 IRC Section R602.12.6.3 to contributing 0.75 bracing units to the required amount of bracing. The contribution amount is based on the 1.5 multiplier to the length of the vertical leg of the portal frame permitted in Table R602.10.5. This multiplier was added in the "legacy" IRC provisions because Method PFG was restricted for use in areas of low seismicity (SDCs A, B and C).

Cyclic testing conducted at APA in 2006 of the CS-PF (Continuous Sheathed – Portal Frame) showed that the CS-PF has a design strength at least as high as the PFG tested in a similar manner. Based on the results of this testing it is reasonable to permit the same contributing amount of bracing units for the Method CS-PF when similarly restricted to areas of low seismicity as is the Simplified Method.

Please note that the CS-PF portal frame can have a leg length as small at 16 inches, where the PFG has a minimum leg length of 24 inches. What makes the CS-PF perform as well or better than the PFG, even with a shorter leg length, is the fact that the CS-PF has nearly twice as many fasteners as the PFG. It is the fastener interaction between the framing and sheathing that determine the ultimate capacity of this wood-structural-panel/framing bracing system.

Note that the IRC bracing provisions are difficult to meet in many cases as a result of narrow lot widths and the aesthetic requirements of modern homes. Areas around garages and picture windows are especially difficult to accommodate and still meet the minimum bracing requirements of the code. Permitting the equal-to-stronger minimum 16-inch CS-PF the to have the same adjustment factor as the 24-inch PFG is both rational and extremely helpful in broadening the scope of the 2012 IRC Simplified Bracing provisions.

We ask the committee to permit the 16-inch CS-PF the same 0.75 bracing unit contribution as is applied to the 24-inch PFG when used in the Simplified Bracing Method. This is based on full-scale cyclic load tests described in APA Test Report T2006-29 and NAHB-Research Center Test Report EG5522_08216.

Cost Impact: The code change proposal will not increase the cost of construction.

RB327-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12.6.2-RB-KEITH.doc

RB328 – 13
R602.12.6.3

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R602.12.6.3 Methods ABW, PFH and PFG. *Braced wall panels* constructed as Methods ABW, PFH and PFG shall be permitted when bracing units are constructed using wood structural panels applied either continuously or intermittently. Each ABW and PFH panel shall equal one bracing unit, and each PFG panel shall be equal to 0.75 bracing units.

Reason: This proposal adds the traditional bracing method with hold downs (Method ABW) to the list of permitted bracing methods that may be used with the Simplified Bracing Provisions. Method ABW provides a narrow wall bracing option to the Simplified Method that may assist designers and builders in meeting the hard-to-meet bracing requirements of the first story of a two story structure on a narrow width lot. This method would provide one unit of bracing (36 inches to 48 inches for continuous and intermittent, respectively) for a bracing element as narrow as 28 inches.

With the increases in bracing requirements of the 2009 IRC it is important that designers and builders have the requisite tools to meet these more challenging requirements. Site-built shear walls (ABW), portal frames (PFH and PFG) are essential tools equally beneficial for both intermittent and continuously sheathed walls alike.

Cost Impact: The code change proposal will not increase the cost of construction

RB328-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.12.6.3-RB-KEITH.doc

RB329 – 13

R602.10 (NEW), R602.11, R602.12, Appendix R (NEW)

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee/American Chemistry Council (jcrandell@aresconsulting.biz); Larry Wainright, Structural Building Components Association; Paul Lautrup, OX Engineered Products

Revise as follows:

APPENDIX R
WALL BRACING SUPPLEMENTAL PROVISIONS

~~R602.10~~ AR602.10 Wall bracing.

~~R602.10.~~1 AR602.10.1 Braced wall lines.

~~R602.10.1.1~~ AR602.10.1.1 Length of a braced wall line.

FIGURE ~~R602.10.1.1~~ AR602.10.1.1 BRACED WALL LINES

~~R602.10.1.2~~ AR602.10.1.2 Offsets along a braced wall line.

~~R602.10.1.3~~ AR602.10.1.3 Spacing of braced wall lines.

TABLE ~~R602.10.1.3~~ AR602.10.1.3 BRACED WALL LINE SPACING

~~R602.10.1.~~4 AR602.10.1.4 Angled walls.

FIGURE ~~R602.10.1.~~4 AR602.10.1.4 ANGLED WALLS

~~R602.10.2~~ AR602.10.2 Braced wall panels.

~~R602.10.2.~~1 AR602.10.2.1 Braced wall panel uplift load path.

~~R602.10.2.2~~ AR602.10.2.2 Locations of braced wall panels.

FIGURE ~~R602.10.2.2~~ AR602.10.2.2 LOCATION OF BRACED WALL PANELS

~~R602.10.2.2.1~~ AR602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0, D_1 and D_2.

~~R602.10.2.3~~ AR602.10.2.3 Minimum number of braced wall panels.

~~R602.10.3~~ AR602.10.3 Required length of bracing.

TABLE ~~R602.10.3(1)~~ AR602.10.3(1) BRACING REQUIREMENTS BASED ON WIND SPEED

TABLE ~~R602.10.3(2)~~ AR602.10.3(2) WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

TABLE ~~R602.10.3(3)~~ AR602.10.3(3) BRACOMG REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

TABLE ~~R602.10.3(4)~~ AR602.10.3(4) SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

~~R602.10.4~~ A<u>R602.10.4</u> Construction methods for braced wall panels.

TABLE ~~R602.10.4~~ <u>AR602.10.4</u> BRACING METHODS

~~R602.10.4.1~~ <u>AR602.10.4.1</u> Mixing methods.

~~R602.10.4.2~~ <u>AR602.10.4.2</u> Continuous sheathing methods.

~~R602.10.4.3~~ <u>AR602.10.4.3</u> Braced wall panel interior finish material.

~~R602.10.5~~ <u>AR602.10.5</u> Minimum length of a braced wall panel.

TABLE ~~R602.10.5~~ <u>AR602.10.5</u> MINIMUM LENGTH OF BRACED WALL PANELS

FIGURE ~~R602.10.5~~ <u>AR602.10.5</u> BRACED WALL PANELS WITH CONTINUOUS SHEATHING

~~R602.10.5.1~~ <u>AR602.10.5.1</u> Contributing length.

~~R602.10.5.2~~ <u>AR602.10.5.2</u> Partial credit.

TABLE ~~R602.10.5.2~~ <u>AR602.10.5.2</u> PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH

~~R602.10.6~~ <u>AR602.10.6</u> Construction of Methods ABW, PFH, PFG, CS-PF and BV-WSP.

~~R602.10.6.1~~ <u>AR602.10.6.1</u> Method ABW: Alternate braced wall panels.

TABLE ~~R602.10.6.1~~ <u>AR602.10.6.1</u> MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

FIGURE ~~R602.10.6.1~~ <u>AR602.10.6.1</u> METHOD ABW-ALTERNATE BRACED WALL PANEL

~~R602.10.6.2~~ <u>AR602.10.6.2</u> Method PFH: Portal frame with hold-downs.

FIGURE ~~R602.10.6.2~~ <u>AR602.10.6.2</u> METHOD PFH-PORTAL FRAME WITH HOLD-DOWNS

~~R602.10.6.3~~ <u>AR602.10.6.3</u> Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C.

FIGURE ~~R602.10.6.3~~ <u>AR602.10.6.3</u> METHOD PFG-PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B AND C

~~R602.10.6.4~~ <u>AR602.10.6.4</u> Method CS-PF: Continuously sheathed portal frame.

FIGURE ~~R602.10.6.4~~ <u>AR602.10.6.4</u> METHOD CS-PF-CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

TABLE ~~R602.10.6.4~~ <u>AR602.10.6.4</u> TENSION STRAP CAPACITY REQURIED FOR RESISTING WIND PRESURES PERPENDICULAR TO METHOD PFH, PFG AND CS-PF BRACED WALL PANELS

~~R602.10.6.5~~ <u>AR602.10.6.5</u> Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D_0, D_1 and D_2.

TABLE ~~R602.10.6.5~~ <u>AR602.10.6.5</u> METHOD BV-WSP WALL BRACING REQURIEMENTS

FIGURE ~~R602.10.6.5~~ AR602.10.6.5 METHOD BV-WSP-WALL BRACING FOR DWELLINGS WITH STONE AND MASONRY VENEER IN SEISMIC DESIGN CATEGORIES D_0. D_1, AND D_2

~~R602.10.6.5.1~~ AR602.10.6.5.1 Length of bracing.

~~R602.10.7~~ AR602.10.7 Ends of braced wall lines with continuous sheathing.

FIGURE ~~R602.10.7~~ AR602.10.7 END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

~~R602.10.8~~ AR602.10.8 Braced wall panel connections.

FIGURE ~~R602.10.8(1)~~ AR602.10.8(1) BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING

FIGURE ~~R602.10.8(2)~~ AR602.10.8(2) BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING FRAMING

~~R602.10.8.1~~ AR602.10.8.1 Braced wall panel connections for Seismic Design Categories D_0, D_1 and D_2.

~~R602.10.8.2~~ AR602.10.8.2 Connections to roof framing.

FIGURE ~~R602.10.8.2(1)~~ AR602.10.8.2(1) BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS

FIGURE ~~R602.10.8.2(2)~~ AR602.10.8.2(2) BRACED WALL PANEL CONNCECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

FIGURE ~~R602.10.8.2(3)~~ AR602.10.8.2(3) BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

~~R602.10.9~~ AR602.10.9 Braced wall panel support.

FIGURE ~~R602.10.9~~ AR602.10.9 MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

~~R602.10.9.1~~ AR602.10.9.1 Braced wall panel support for Seismic Design Category D_2.

~~R602.10.10~~ AR602.10.10 Panel joints.

~~R602.10.11~~ AR602.10.11 Cripple wall bracing.

~~R602.10.11.1~~ AR602.10.11.1 Cripple wall bracing for Seismic Design Categories D_0 and D_1 and townhouses in Seismic Design Category C.

~~R602.10.11.2~~ AR602.10.11.2 Cripple wall bracing for Seismic Design Category D_2.

~~R602.10.11.3~~ AR602.10.11.3 Redesignation of cripple walls.

~~R602.11~~ AR602.11 Wall anchorage.

~~R602.11.1~~ AR602.11.1 Wall anchorage for all buildings in Seismic Design Categories D_0, D_1 and D_2 and townhouses in Seismic Design Category C.

~~R602.11.2~~ AR602.11.2 Stepped foundations in Seismic Design Categories D_0, D_1 and D_2.

R602.10 Wall bracing. Buildings, and portions thereof, shall be braced in accordance with one or more of the following sections using bracing materials and methods complying with Section R602.10.1 and load path detailing in accordance with Section R602.10.5:

1. Intermittent bracing per Section R602.10.2,
2. Continuous sheathing per Section R602.10.3,
3. Engineered design per Section R602.10.4, or
4. Appendix R – Wall Bracing Supplemental Provisions

Where a building, or portion thereof, does not comply with Section R602.10.2, Section R602.10.3, or Section R602.10.5, those portions shall be designed and constructed in accordance with Section R602.10.4. Townhouses in Seismic Design Category C and all buildings in Seismic Design Categories D_0, D_1, and D_2 shall comply with the bracing requirements in Appendix R or be designed in accordance with Section R602.10.4.

R602.10.1 Bracing materials and methods. Wall bracing materials and methods shall comply with Table R602.10.1.

TABLE R602.10.1
BRACING METHODS[a,b]

Method	**Minimum Brace Material Thickness or Size**	**Minimum Braced Wall Panel Width or Brace Angle**	**Connection Criteria**	
			Minimum Fasteners	**Maximum Spacing**
LIB Let-in Bracing	1x4 wood brace (or approved metal brace installed per manufacturer instructions)	45° angle and maximum 16"oc stud spacing[c]	2-8d common nails or 3-8d box nails (2-1/2" long x 0.113" dia.)	Per stud and top and bottom plates
DWB Diagonal wood boards	¾" (1" nominal)	48"	2-8d box nails (2-1/2" long x 0.113" diameter) or 2 – 1-3/4" long 16ga. staples	Per stud and top and bottom plates
WSP Wood structural panel	3/8"	48"[d]	6d common nail or 8d box nail (2-1/2" long x 0.113" diameter)	6" edges, 12" field
SFB Structural Fiberboard Sheathing	½"	48"[d]	1-1/2" long x 0.120" dia. galvanized roofing nails	3" edges, 6" field
GB Gypsum Board (installed on both sides of wall)	½"	96" (48" for use with Section R602.10.3)	5d cooler nails or #6 screws	7" edges, 7" field (including top and bottom plates)
PCP Portland cement plaster	¾" (maximum 16"oc stud spacing)	48"	1-1/2" long, 11 gage, 7/16" diameter head nails or 7/8"	6" o.c. on all framing members

			long, 16 gage staples	
CS-WSP[e] Continuously sheathed WSP	3/8"	Refer to Table R602.10.1.1	Same as WSP	Same as WSP
CS-SFB[e] Continuously sheathed SFB	½"		Same as SFB	Same as SFB
PF Portal Frame[f]	7/16"	See Figure R602.10.1	See Figure R602.10.1	See Figure R602.10.1

For SI: 1 inch = 25.4 mm

a. Alternative bracing materials and methods, when approved in accordance with Section R104.11, shall be permitted to be used as a substitute for any of the bracing materials listed in Table R602.10.1 provided at least equivalent performance is demonstrated. Where the tested bracing strength or stiffness differs from tabulated materials, the bracing amount required for the alternative material shall be permitted to be factored to achieve equivalence.

b. All edges of panel-type wall bracing shall be attached to framing or blocking, except GB bracing horizontal joints shall not be required to be blocked where joints are finished.

c. Method LIB shall not be permitted for walls supporting a roof and two stories. Two LIB braces installed at a 60° angle shall be permitted to be substituted for each 45° angle LIB brace.

d. A braced wall panel shall be permitted to be reduced to a 32-inch length when studs at each end of the braced wall panel are anchored to foundation or framing below using hold-down device with minimum 2,800 lbs design tension capacity. For detached single story garages and attached garages supporting roof only, a minimum 24-inch brace panel length shall be permitted on one wall containing one or more garage door openings.

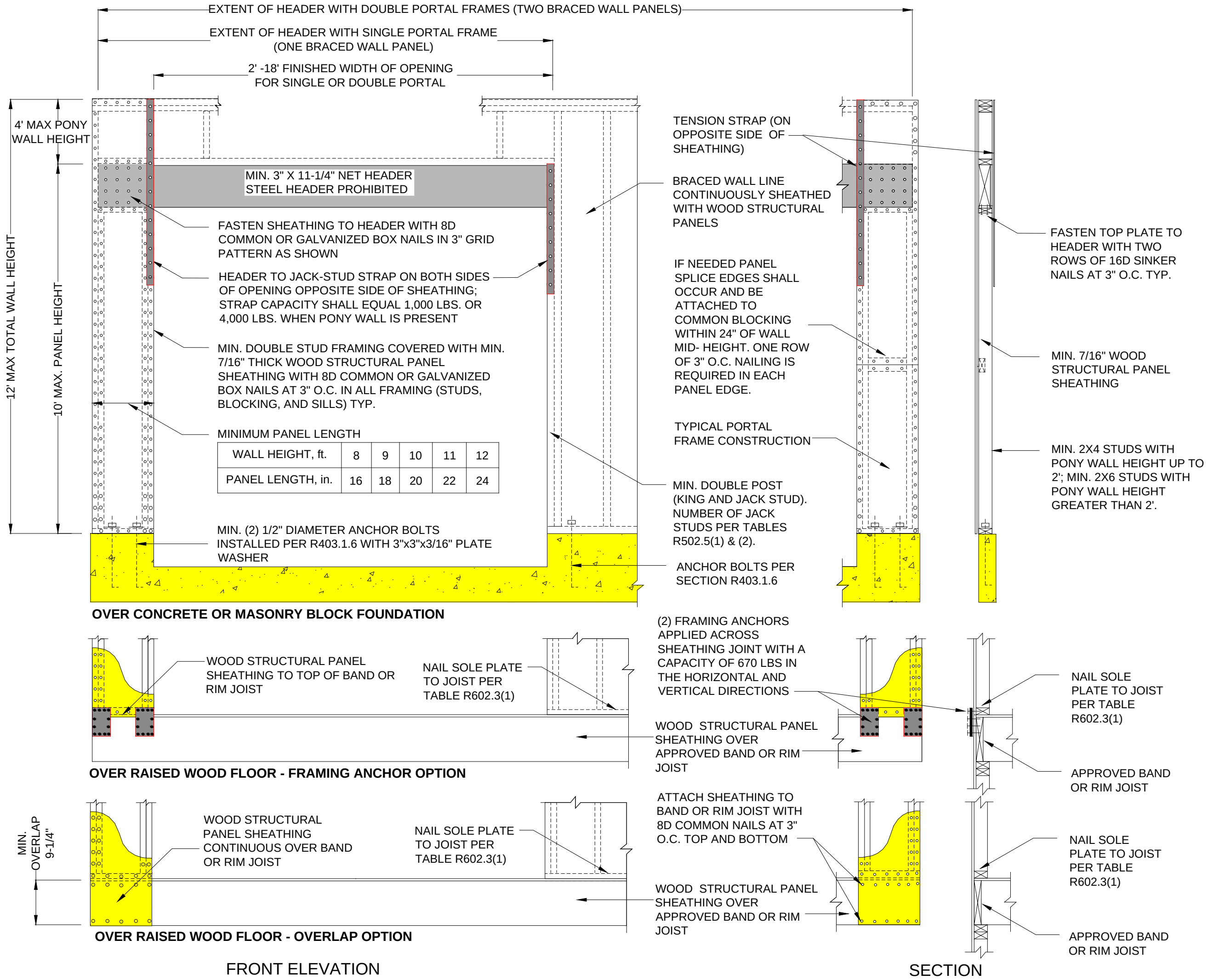
e. Bracing methods CS-WSP and CS-SFB shall have sheathing installed on all sheathable surfaces above, below, and between wall openings.

f. For purposes of bracing in accordance with Section R602.10.2, two Method PF brace panels having a minimum width of 24-inches each shall be considered equivalent to one braced wall panel.

TABLE R602.10.1.1
MINIMUM WIDTHS OF METHOD CS-WSP AND CS-SFB BRACED WALL PANELS

Maximum Opening Height Adjacent to Braced Wall Panel	**Minimum Length of Braced Wall Panel (inches)**			
	8' tall wall	**9' tall wall**	**10' tall wall**	**12' tall wall**
Up to 5' – 4"	24	27	30	36
Up to 6' – 8"	32	30	30	36
Up to 8'	48	41	38	36
Up to 9'	-	54	46	41
Up to 10'	-	-	60	48
Up to 12'	-	-	-	72

For SI: 1 foot = 305 mm, 1 inch = 25.4 mm



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N
NOTE: Minimum PF panel length shall be 24 inches (610 mm) for use with Section R602.10.2.

FIGURE R602.10.1
METHOD PF – PORTAL FRAME CONSTRUCTION

602.10.2. Intermittent Bracing. Intermittent bracing shall comply with Sections R602.10.2.1 and R602.10.2.2.

R602.10.2.1 Limitations. The intermittent bracing requirements of Section R602.10.2.2 shall be limited to the following conditions of use:

1. Basic design wind speed shall not exceed 100 mph (161 km/h).
2. Bracing methods shall be LIB, DWB, WSP, SFB, GB, PCP, and PF in accordance with Table R602.10.1.
3. Overall plan length of the house is limited to 75 feet (22.9 m) and the overall plan width shall be no less than one-third the overall plan length.
4. Wall height at each story level shall not exceed 10 feet (3.05 m).
5. Roof eave-to-ridge height shall not exceed 10 feet (3.05 m) unless the roof is considered as an additional story for the purpose of determining bracing amounts required.
6. Except where used as bracing method GB, minimum ½-inch-thick gypsum wall board interior finish, or approved interior finish of equivalent or greater shear resistance, shall be installed on the interior side of exterior walls and both sides of interior walls and fastened in accordance with Table R702.3.5.
7. Floors supporting brace panels shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
8. Townhouses shall be stabilized independently of adjacent units unless a design is provided to permit lateral load transfer between adjacent units.

R602.10.2.2 Requirements. Braced wall panels shall be constructed of bracing methods, materials, and minimum braced panel lengths complying with Table R602.10.1. The number of braced wall panels required for each side of a building (elevation view) at each story level of the building shall comply with Table R602.10.2 and shall be oriented parallel to the building side. The following additional requirements shall apply:

1. In no case shall the amount of bracing be less than two braced wall panels on exterior walls comprising each side of a building (elevation view) for each story level of the building.
2. Braced wall panel shall be located on each building side at each story level in accordance with Figure R602.10.2.2.
3. No more than one-half the number of braced wall panels required on a building side shall be permitted to be relocated from exterior walls to interior walls oriented in the same plan direction and within one-half the floor plan dimension perpendicular to the exterior wall.
4. Use of multiple bracing methods and materials complying with Table R602.10.1 shall be permitted.
5. Houses with skewed wings shall be constructed in accordance with either Section R602.10.3 or designed in accordance with Section R602.10.4.
6. Garage door openings supporting a floor load above shall be braced using Method PF unless the building plan level containing the garage opening wall complies with all the bracing requirements of this section.
7. The bracing amount provided on an upper story building side shall be “deemed-to-comply” where it equals or exceeds the amount of bracing required for the story immediately below.

TABLE R602.10.2
NUMBER OF BRACED WALL PANELS REQUIRED
FOR EACH HOUSE ELEVATION (BUILDING SIDE) AT EACH STORY LEVEL[1]

Wind Velocity	Story Level Supporting:	Longest Overall Dimension of Floor Plan for a Given Story Level		
		25’	50’	75’
90 mph	Roof Only	1	2	3
	Roof + 1 Story	2	4	6
	Roof + 2 Stories	3	6	9
100 mph	Roof Only	2	3	4
	Roof + 1 Story	3	5	8
	Roof + 2 Stories	4	8	11

For SI: 1 foot = 305 mm

a. Interpolation between dimensions shall be permitted. Extrapolation is prohibited.

b. Table applies to wind exposure B. For wind exposure C or D, multiply number of braced wall panels required by 1.3 or 1.6, respectively.

c. Fractions of panels shall be rounded to the nearest one-half braced wall panel. The following braced wall panel conditions shall be permitted to be counted as one-half a braced wall panel: (1) one 60 degree LIB, (2) one 48” GB or one 96” GB with gypsum wall board on one side, or (3) one 36” WSP, SFB, or PCP braced wall panel for wall heights not more than 9 feet (2.75 m).

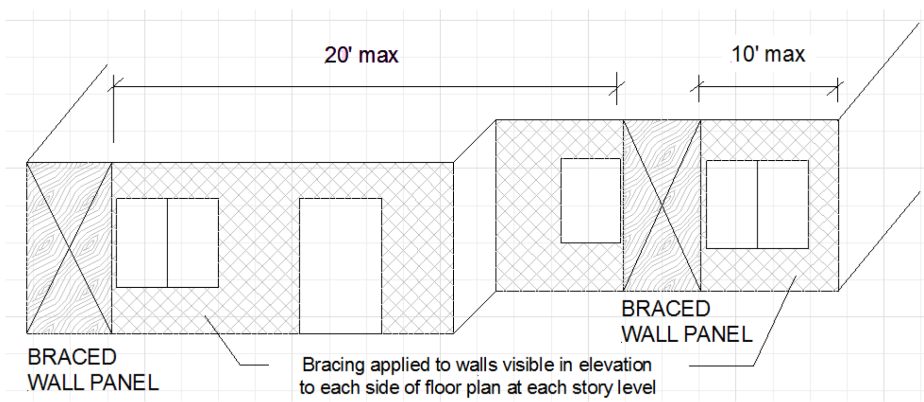


FIGURE R602.10.2.2
LOCATION OF BRACED WALL PANELS

R602.10.3 Continuous Sheathing.

R602.10.3.1 Limitations. The continuous sheathing requirements of Section R602.10.3 shall be limited to bracing methods CS-WSP and CS-SFB in accordance with Table R602.10.1 with the following conditions of use:

1. Basic design wind speed shall not exceed 110 mph (177 km/h).
2. Wall height at each story level shall not exceed 12 feet (3.66 m).
3. Eave to ridge height shall not exceed 20 feet (6.10 m).
4. Exterior walls shall be sheathed on all sheathable surfaces including infill areas between braced wall panels, above and below wall openings and on gable end walls.
5. Except where used as bracing method GB, minimum ½-inch-thick gypsum wall board interior finish, or approved interior finish of equivalent or greater shear resistance, shall be installed on the interior side of exterior walls and both sides of interior walls and fastened in accordance with Table R702.3.5.
6. Floors supporting braced wall panels shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
7. Townhouses shall be stabilized independently of adjacent units, unless a design is provided to permit lateral load transfer between adjacent units.

R602.10.3.2 Requirements. The required length of bracing for each side of a building (plan elevation) at each story level shall be determined using Table R602.10.3 and Figure R602.10.3(1). The cumulative contributing length of braced wall panels assigned to a rectangle side and each complying with Table R602.10.1.1 shall be greater than or equal to the required length of bracing. The following additional requirements shall apply:

1. Braced wall panels on exterior or interior walls shall be assigned to the nearest rectangle side as shown in Figure R602.10.3(2) for each story level floor plan.
2. Braced wall panels shall be distributed and installed in accordance with Figure R602.10.3(3).
3. A minimum of one-half the required bracing amount for each rectangle side should be located on exterior walls within 8 feet of the location of the rectangle side.
4. Interior braced wall panels using Method GB shall be assigned to the closest parallel rectangle side and shall contribute 0.5 times their actual length.
5. The bracing amount provided on an upper story building side shall be "deemed-to-comply" where it equals or exceeds the amount of bracing required for the story immediately below.

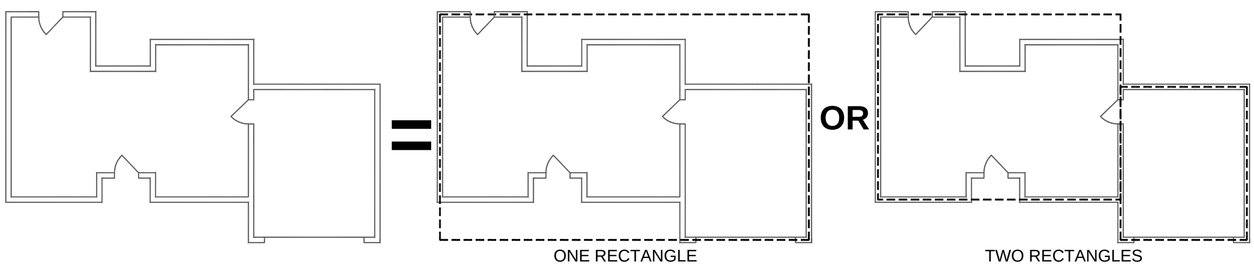


FIGURE R602.10.3(1)
CIRCUMSCRIBED RECTANGLES[a,b,c]

a. Each floor plan level shall be circumscribed with one or more rectangles around the entire floor plan at the floor level under consideration as shown in Figure R602.10.3.
b. Rectangles shall surround all enclosed offsets and projections such as sunrooms and attached garages for a given story level floor plan. Chimneys, partial height projections, and open structures, such as carports and decks, shall be excluded from the rectangle.
c. Each rectangle shall have no side greater than 80 feet (24.4 m) with a maximum rectangle length-to-width ratio of 3:1. Rectangles shall be permitted to be skewed to accommodate diagonal walls.

TABLE R602.10.3
REQUIRED LENGTH OF BRACING ALONG EACH SIDE OF A CIRCUMSCRIBED RECTANGLE [a,b,c,d]

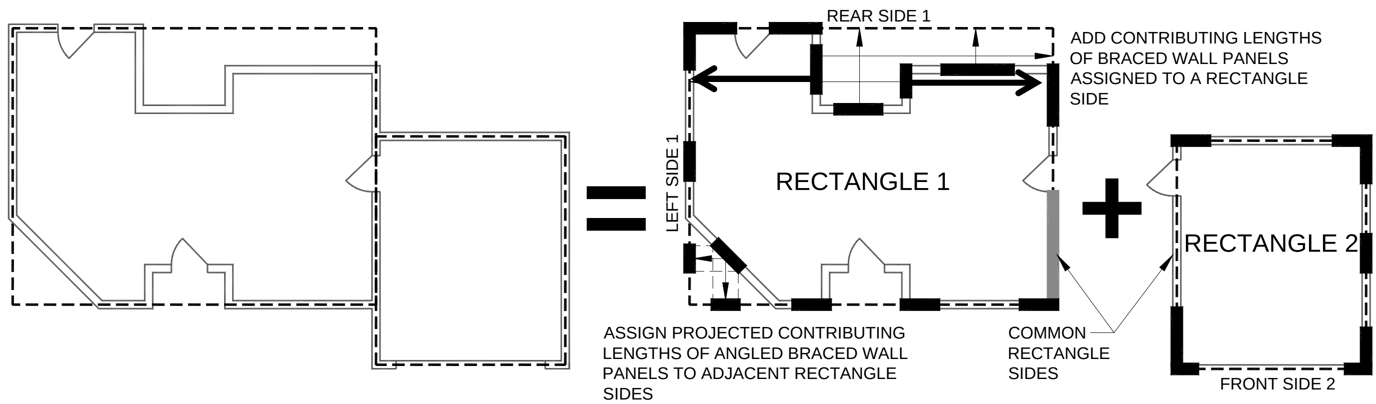
WIND SPEED	EAVE-TO RIDGE HEIGHT (FEET)	NUMBER OF LEVELS ABOVE [e]	REQUIRED LENGTH (FEET) OF BRACING ON ANYSIDE OF RECTANGLE — Length of perpendicular side (ft)[f] 10	20	30	40	50	60	70	80
90	10	None	2.0	3.5	5.0	6.0	7.5	9.0	10.5	12.0
		One story	3.5	6.5	9.0	12.0	14.5	17.0	19.8	22.6
		Two stories	5.0	9.5	13.5	17.5	21.5	25.5	29.2	33.4
	15	None	2.6	4.6	6.5	7.8	9.8	11.7	13.7	15.7
		One story	4.0	7.5	10.4	13.8	16.7	19.6	22.9	26.2
		Two stories	5.5	10.5	14.9	19.3	23.7	27.5	32.1	36.7
	20	None	2.9	5.2	7.3	8.8	11.1	13.2	15.4	17.6
		One story	4.5	8.5	11.8	15.6	18.9	22.1	25.8	29.5
		Two stories	6.2	11.9	16.8	21.8	27.3	31.1	36.3	41.5
100	10	None	2.5	4.0	6.0	7.5	9.5	11.0	12.8	14.6
		One story	4.5	8.0	11.0	14.5	18.0	21.0	24.5	28.0
		Two stories	6.0	11.5	16.5	21.5	26.5	31.0	36.2	41.4
	15	None	3.4	5.2	7.8	9.8	12.4	14.3	16.7	19.1
		One story	5.2	9.2	12.7	16.7	20.7	24.2	28.2	32.2
		Two stories	6.6	12.7	18.2	23.7	29.2	34.1	39.8	45.5
	20	None	3.8	5.9	8.8	11.1	14.0	16.2	18.9	21.6
		One story	5.9	10.4	14.4	18.9	23.4	27.3	31.8	36.3
		Two stories	7.5	14.4	20.6	26.8	33.0	38.5	44.9	51.3
110	10	None	3.0	5.0	7.0	9.0	11.5	13.3	15.5	17.5
		One story	5.0	9.5	13.5	17.5	21.5	25.5	29.5	34.0
		Two stories	7.5	14.0	20.0	26.0	32.0	37.5	44.0	50.0
	15	None	4.2	6.3	9.5	11.9	15.0	17.3	20.2	23.1
		One story	6.3	11.2	15.4	20.2	25.0	29.3	34.2	39.1
		Two stories	8.0	15.4	22.0	28.7	35.3	41.3	48.2	55.1
	20	None	4.6	7.2	10.6	13.4	16.9	19.6	22.9	26.2
		One story	7.2	12.6	17.4	22.9	28.3	33.0	38.5	44.0
		Two stories	9.1	17.4	24.9	32.4	39.9	46.6	54.4	62.2

For SI: 1 ft = 304.8 mm

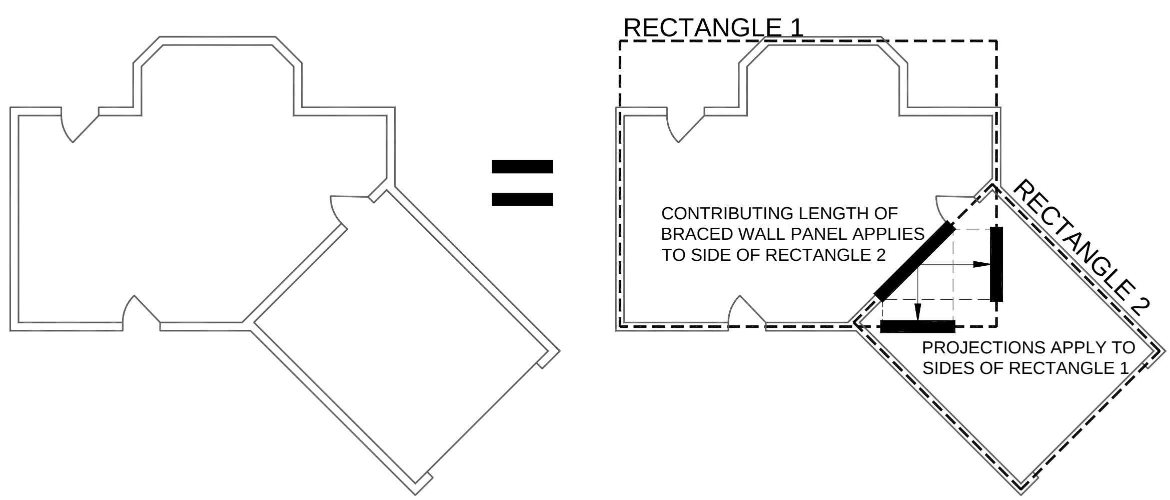
a. Interpolation shall be permitted; extrapolation shall be prohibited.
b. For Exposure Category C or D, multiply the required length of bracing by a factor of 1.3 or 1.6, respectively.
c. For wall heights other than 10 ft (3.05 m), multiply the required length of bracing by the following factors: 0.90 for 8 feet (2.44 m), 0.95 for 9 feet (2.74 m), 1.05 for 11 feet (3.35 m) and 1.10 for 12 feet (3.66 m).
d. Where minimum ½" gypsum wall board interior finish is not provided, the required bracing amount for the affected rectangle side shall be multiplied by 1.40.

e. A floor, habitable or otherwise, contained wholly within the roof rafters or roof trusses need not be considered a story for purposes of determining wall bracing provided the eave to ridge height does not exceed 20 feet (6.10 m).

f. Perpendicular sides to the front and rear sides are the left and right sides. Perpendicular sides to the left and right sides are the front and rear sides.



(a) Regular Floor Plan



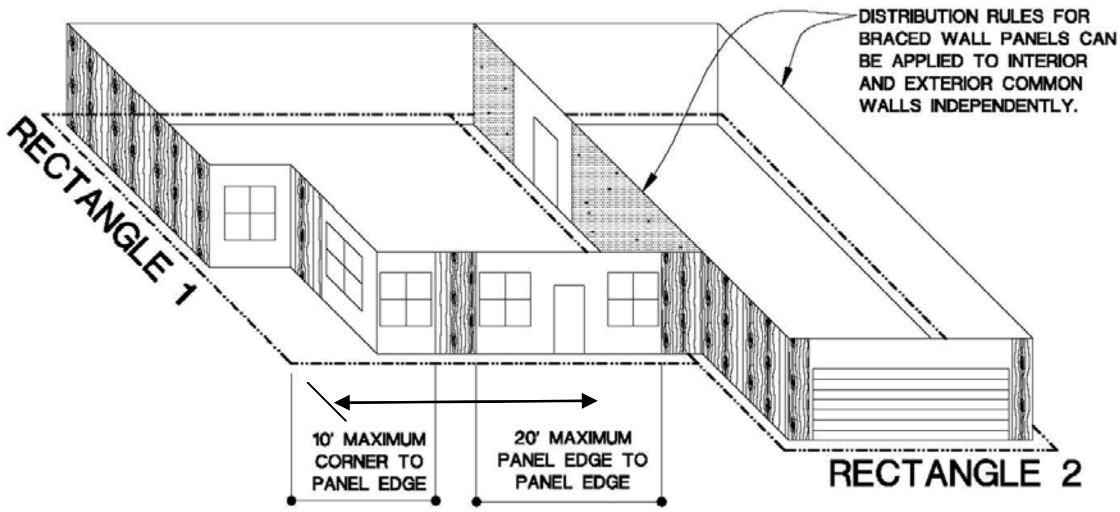
(b) Skewed Floor Plan

FIGURE R602.10.3(2)
ASSIGNMENT OF BRACED WALL PANELS
CIRCUMSCRIBED RECTANGLE SIDES[a,b,c]

a. Projected contributing lengths of angled braced wall panels shall be assigned to the closest rectangle sides.

b. Where multiple rectangles share a common side or sides, as shown in Figure R602.10.3(2)(a), the total required length of bracing on the common side shall equal the sum of the required lengths from each of the shared rectangle sides.

c. Braced wall panels located on a common wall where skewed rectangles intersect, as shown in Figure R602.10.3(2)(b), shall have their contributing length applied towards the required length of bracing for the parallel rectangle side and its projected contributing lengths towards the adjacent skewed rectangle sides. Where the common side of rectangle 2 as shown in Figure R602.10.3(2)(b) has no physical wall, the portion shall be designed in accordance with Section R602.10.4.



For SI: 1 ft = 304.8 mm

FIGURE R602.10.3(3)
DISTRIBUTION OF BRACED WALL PANELS[a,b,c,d]

a. A braced wall panel complying with Table R602.10.1.1 shall be located on each elevation view within 10 feet (3.05 m) of the corners of circumscribed rectangles.
b. The distance between adjacent edges of braced wall panels shall be no more than 20 feet (6.10 m) as measured along the rectangle side.
c. A minimum 24-inch-wide CS-WSP or 32-inch-wide CS-SFB panel shall be located on each side of inside and outside corners or an 800 lb rated tie-down shall be fastened to the edge of the braced wall panel closest to each corner.
d. Interior and exterior wall segments which contribute to the common sides of multiple rectangles shall be permitted to apply the distribution requirements given above to each wall segment independently.

R602.10.4 Wall bracing by engineered design. Designs using bracing materials and methods listed in Table R602.10.1 or approved alternative materials and methods shall be permitted and shall comply with accepted engineering practice. Accepted engineering practice shall include the following:

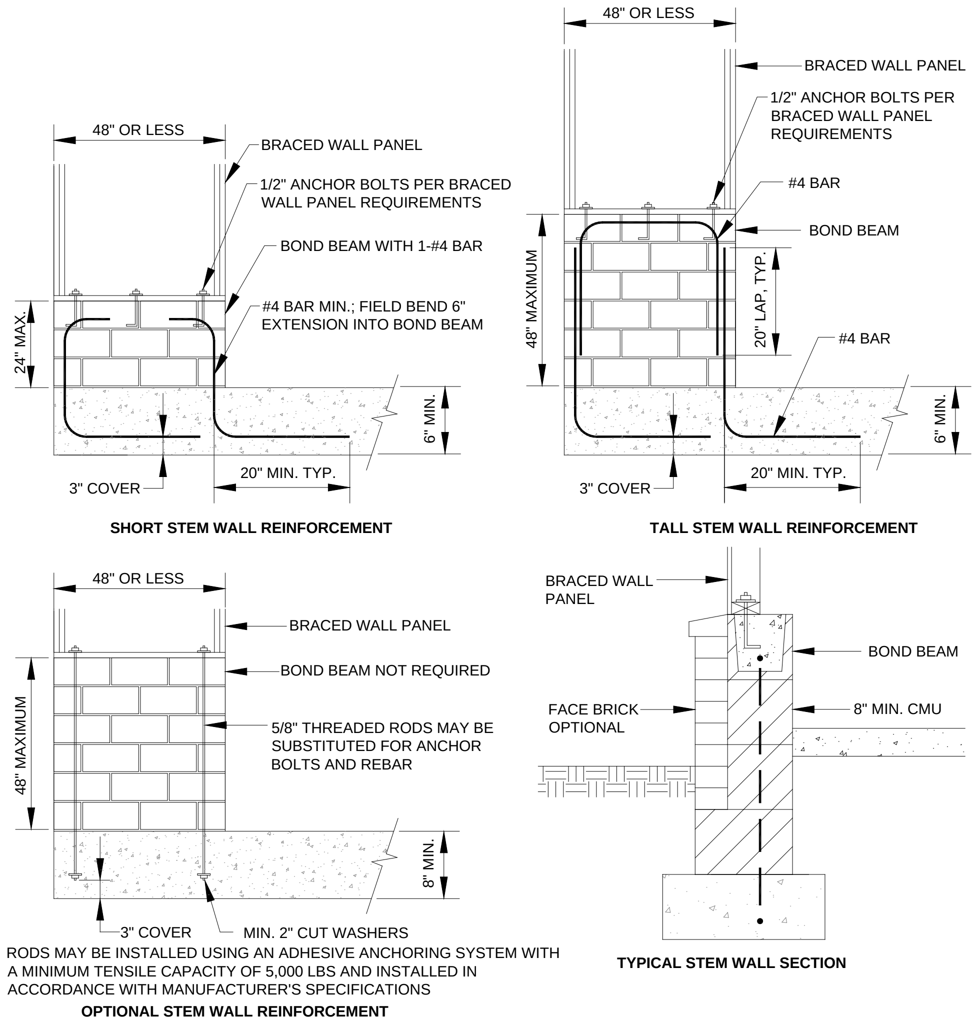
1. Design in accordance with Section R301, or
2. Design equivalent to the analysis basis and scope of the prescriptive provisions of R602.10, including determination of design loads, design unit shear values, and bracing amounts.

R602.10.5 Load path details. Construction shall comply with applicable detailing requirements of this section to ensure an adequate continuous load path for transfer of bracing loads and uplift loads from the roof to the foundation.

R602.10.5.1 Wind uplift load path. Framing connections to transfer roof uplift forces shall comply with Section R602.3.5 and Section R802.11.

R602.10.5.2 Foundation anchorage. Braced wall panels shall be connected to the foundation per Section R403.1.6 and as required in Figure R602.10.1 for portal frames (Method PF).

R602.10.5.3 Masonry or concrete pedestals. Masonry or concrete stem walls with a length of 48 inches (1220 mm) or less supporting braced wall panels shall be reinforced in accordance with Figure R602.10.4.3. Concrete stem walls shall be 6” nominal minimum thickness.



NOTE: GROUT BOND BEAMS AND ALL CELLS WHICH CONTAIN REBAR, THREADED RODS AND ANCHOR BOLTS.

For SI: 1 in=25.4 mm

FIGURE R602.10.5.3
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.5.4 Blocking of floor framing. When parallel to floor framing, braced wall panels shall be connected to a band, rim or header joist, floor framing or perpendicular full-height solid blocking between floor framing at 16 inches (406 mm) on center. When perpendicular to floor framing, braced wall panels shall be connected to full-height solid blocking between floor framing. Attachments shall be in accordance with Table R602.3(1). Manufactured lumber or truss blocking panels shall be permitted to substitute for full-height solid blocking.

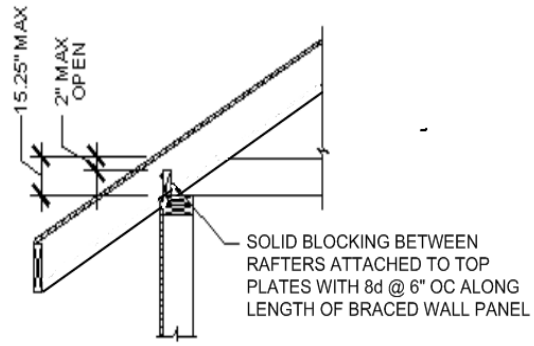
R602.10.5.5 Blocking of roof framing. When parallel to roof framing, braced wall panels shall be connected to a band, rim or header joist, or roof truss. When perpendicular to roof framing, the top plates of exterior braced wall panels shall be connected to the rafters or roof trusses above in accordance with Table R602.10.5.5 and fastened in accordance with Table R602.3(1).

TABLE R602.10.5.5
BRACED WALL PANEL CONNECTIONS TO PERPENDICULAR ROOF FRAMING

DISTANCE FROM TOP OF BRACED WALL PANEL TO TOP OF RAFTER OR ROOF	REQUIREMENT	REFERENCED FIGURE

TRUSS, (in)		
≤ 9.25	No blocking required	NA
9.25 – 15.25	Solid 2x blocking between rafters or trusses	R602.10.5.5(1)
15.25 – 48	Vertical blocking panels	R602.10.5.5(2)
> 48	Designed in accordance with accepted engineering practice	NA

For SI: 1 inch = 25.4 mm



For SI: 1 inch = 25.4 mm

FIGURE R602.10.5.5(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS OR TRUSSES

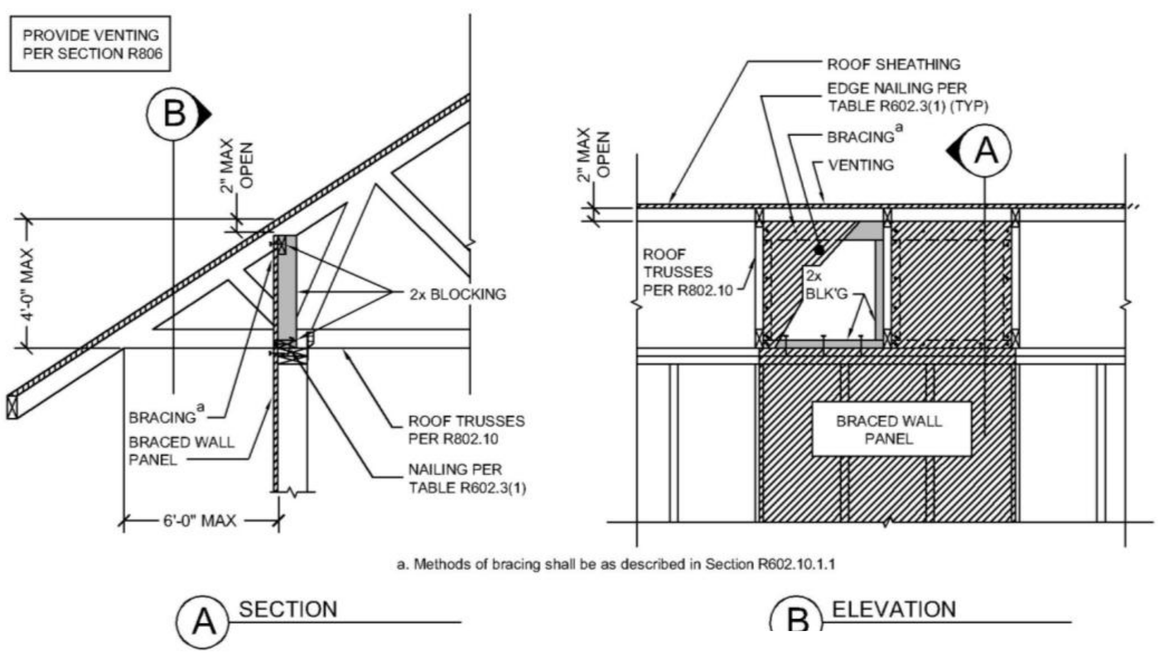


FIGURE R602.10.5.5(2)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

R602.10.5.6 Cripple walls and framed walls of walk-out basements. The required length of bracing for cripple walls with a maximum height of 48 inches (1220 mm) or less along its entire length shall be equal to the wall above. The required length of bracing for cripple walls with a height greater than 48 inches (1220 mm) at any location along its length and for framed walls of a walk-out basement shall be determined in accordance with Section R602.10.2 or R602.10.3, considering the cripple wall or walk-out basement as an additional story. As an alternative, the required length of bracing shall be permitted to equal to the wall above multiplied by a factor of 1.15.

R602.10.5.7 Open Elevated Foundations. Open elevated foundations, such as pile foundations shall be constructed to transfer all lateral loads from the wall bracing system to the piles or elevated piers, including shears, overturning, and uplift loads. Piles or elevated piers along with their foundations shall be sized and/or embedded to transfer all lateral loads imposed by the wall bracing system to the ground.

R602.10.5.8 Balloon frame wall bracing. Balloon frame walls shall have a maximum height of two stories unless constructed in accordance with an approved design. Wall framing shall be continuous from lowest floor to the wall top plate at the roof. Braced wall panels shall extend to the full-height of the balloon frame wall. All edges of sheathing shall be supported on and fastened to blocking or framing. The required brace wall panel length assigned to the balloon frame wall shall be based on the bracing required for the lowest floor level supporting the balloon frame wall as determined in accordance with Section R602.10.2 or R602.10.3. For balloon framed walls having a maximum height of two stories and a maximum length of 12 feet (3.66 m), braced wall panels shall be permitted to be placed parallel to the balloon framed wall on each side and at each story adjacent to the balloon framed wall, and no bracing shall be required for the balloon frame wall portion. Two story interior open ceiling areas shall not extend into the building from the balloon frame wall more than one-half the distance to the opposite building side unless bracing around the opening in the floor diaphragm is designed in accordance with Section R602.10.4.

~~**R602.12 Simplified wall bracing.** Buildings meeting all of the conditions listed in items 1-8 shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.~~

1. ~~There shall be no more than two stories above the top of a concrete or masonry foundation or basement wall.Permanent wood foundations shall not be permitted.~~
2. ~~Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.~~
3. ~~Wall height shall not be greater than 10 feet (2743 mm).~~
4. ~~The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.~~
5. ~~All exterior walls shall have gypsum board with a minimum thickness of 1/2 inch (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.~~
6. ~~The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B.~~
7. ~~The structure shall be located in Seismic Design Category A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.~~
8. ~~Cripple walls shall not be permitted in two-story buildings.~~

~~**R602.12.1 Circumscribed rectangle.** The bracing required for each building shall be determined by circumscribing a rectangle around the entire building on each floor as shown in Figure R602.12.1. The rectangle shall surround all enclosed offsets and projections such as sunrooms and attached garages. Open structures, such as carports and decks, shall be permitted to be excluded. The rectangle shall have no side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be a maximum of 3:1.~~

~~**R602.12.2 Sheathing materials.** The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.3. Mixing materials is prohibited.~~

1. ~~Wood structural panels with a minimum thickness of 3/8 inch (9.5 mm) fastened in accordance with Table R602.3(3).~~

2. ~~Structural fiberboard sheathing with a minimum thickness of $^1/_2$ inch (12.7 mm) fastened in accordance with Table R602.3(1).~~

~~**R602.12.3 Bracing unit.** A bracing unit shall be a full-height sheathed segment of the exterior wall with no openings or vertical or horizontal offsets and a minimum length as specified herein. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 is prohibited on the same story.~~

1. ~~Where all framed portions of all exterior walls are sheathed in accordance with Section R602.12.2, including wall areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).~~
2. ~~Where the exterior walls are braced with sheathing panels in accordance with Section R602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).~~

~~**R602.12.3.1 Multiple bracing units.** Segments of wall compliant with Section R602.12.3 and longer than the minimum bracing unit length shall be considered as multiple bracing units. The number of bracing units shall be determined by dividing the wall segment length by the minimum bracing unit length. Full-height sheathed segments of wall narrower than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section R602.12.6.~~

~~**R602.12.4 Number of bracing units.** Each side of the circumscribed rectangle, as shown in Figure R602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table R602.12.4 placed on the parallel exterior walls facing the side of the rectangle. Bracing units shall then be placed using the distribution requirements specified in Section R602.12.5.~~

~~**R602.12.5 Distribution of bracing units.** The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure R602.12.5.~~

1. ~~A bracing unit shall begin no more than 12 feet (3658 mm) from any wall corner.~~
2. ~~The distance between adjacent edges of bracing units shall be no greater than 20 feet (6096 mm).~~
3. ~~Segments of wall greater than 8 feet (2438 mm) in length shall have a minimum of one bracing unit.~~

~~**R602.12.6 Narrow panels.** The bracing methods referenced in Section R602.10 and specified in Sections R602.12.6.1 through R602.12.6.3 shall be permitted when using simplified wall bracing.~~

~~**R602.12.6.1 Method CS-G.** *Braced wall panels* constructed as Method CS-G in accordance with Tables R602.10.4 and R602.10.5 shall be permitted for one-story garages when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-G panel shall be equivalent to 0.5 of a bracing unit. Segments of wall which include a Method CS-G panel shall meet the requirements of Section R602.10.4.2.~~

~~**R602.12.6.2 Method CS-PF.** *Braced wall panels* constructed as Method CS-PF in accordance with Section R602.10.6.4 shall be permitted when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.5 bracing units. A maximum of four CS-PF panels shall be permitted on all segments of walls parallel to each side of the circumscribed rectangle. Segments of wall which include a Method CS-PF panel shall meet the requirements of Section R602.10.4.2.~~

~~**R602.12.6.3 Methods PFH and PFG.** *Braced wall panels* constructed as Method PFH and PFG shall be permitted when bracing units are constructed using wood structural panels. Each PFH panel shall equal one bracing unit and each PFG panel shall be equal to 0.75 bracing units.~~

~~**R602.12.7 Lateral support.** For bracing units located along the eaves, the vertical distance from the outside edge of the top wall plate to the roof sheathing above shall not exceed 9.25 inches (235 mm) at the location of a bracing unit unless lateral support is provided in accordance with Section R602.10.8.2.~~

~~**R602.12.8 Stem walls.** Masonry stem walls with a height and length of 48 inches (1219 mm) or less supporting a bracing unit or a Method CS-G, CS-PF or PFG *braced wall panel* shall be constructed in accordance with Figure R602.10.9. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall be reinforced sized and located in accordance with Figure R602.10.9.~~

Reason: In recent years, great concern has arisen regarding the complexity of the IRC wall bracing provisions. Much good work was done by the ICC Ad Hoc Wall Bracing Committee to resolve significant technical issues and deficiencies in the IRC bracing provisions, including conventional bracing provisions which had not kept up with changes in housing over the years, resulting in concerns with structural safety and performance. Unfortunately, the technical solutions required added complexity to resolve. Now, in an understandable reaction to this added complexity, many attempts are being made to simplify the wall bracing provisions. However, some of these attempts at simplicity are doing so by essentially picking “winners and losers” (e.g., removing certain bracing methods and materials from consideration in a favored simplified approach). The approach of this proposal is to be inclusive and simple while adhering to the technical advancements achieved by the ICC Ad Hoc Wall Bracing Committee.

The proposal is formatted as follows for ease of use:

1. Section R602.10 -- provides charging language for two simplified bracing approaches (intermittent and continuous), an engineered approach, and the existing IRC 2012 provisions (Appendix R).
2. Section R602.10.1 – provides bracing methods and materials common to both simplified methods and is non-exclusive. [1 sentence, 2 Tables, and 1 Figure]
3. Section R602.10.2 – simplified intermittent bracing (for low wind only, 90 and 100 mph) [1 page of text, 1 Table, 1 Figure]
4. Section R602.10.3 – simplified continuous bracing (for up to 110 mph, wind); [1 page of text, 1 Table and 3 Figures]
5. Section R602.10.4 – provides two engineering approaches, one of which is consistent with IRC bracing provisions to permit engineered solutions analyzed in a manner equivalent to the IRC; [1 paragraph of text]
6. Section R602.10.5 – provides various load path details important to overall building performance and connectivity for any bracing method.[2-1/2 pages including text, figures, and table]

To achieve the goal of this proposal, several factors have been considered as described next.

First, Canada recently updated its residential wall bracing provisions considering the same issues and data that the ICC Ad Hoc Committee considered. However, they ended up with a different solution worthy of consideration and, thus, influenced the approach taken in this proposal. Their approach essentially continued traditional (conventional) bracing practices in the lowest hazard regions of the country in recognition that bracing problems were rare (even in newer homes) in this condition. Thus, for much of the country the simple “status quo” was considered adequate absent any strong evidence to the contrary. This same approach is relevant to the US. In moderate hazard regions of the country, an approach similar to that developed by the IRC Ad Hoc Wall Bracing Committee was implemented in Canada. Finally, in the most extreme high hazard regions of Canada engineered design was implemented (which is already the case for many of the high hazard areas in the US).

Second, a simple and limited scope conventional bracing practice is still effective in the IBC, Section 2308. If these provisions are still considered adequate for commercial building applications, then are they not also suitable for housing? The continuing existence and use of the IBC 2308 conventional wall bracing provisions, as well as past experience, suggest strongly that the answer is YES. The IBC 2308 conventional bracing provisions are inclusive and simple to use. Further, they have been recently reformatted for clarity in IBC 2015 proposal S273-11/12 which was approved at the Group A FAH last fall. Therefore, this proposal makes use of this concept, upgrades the approach to improve bracing performance for wind, and applies it in a limited set of conditions for housing in the IRC applicable only to the lowest hazard regions where past experience has been successful. Again, this action also is consistent with the approach taken in Canada after deliberations of a special task group.

Third, for a broader range of hazard conditions covered by the IRC, a simplified approach based primarily on continuous sheathing methods is adopted. This approach is similar to that being considered in various states (including VA from which this approach was derived). As hazards become greater and bracing loads on homes increase, continuous sheathed bracing becomes a more viable and practical bracing method for homes. This is driven by practicality and performance, not simply as a matter of picking “winners and losers” in the interest of simplifying the code by reducing bracing options and restricting market competition without clear cause in even the lowest hazard regions.

Fourth, in areas where hazards and bracing loads are extreme, engineered solutions provide a better means of maintaining simplicity, affordability or efficiency, and performance. An engineered design has a greater ability and flexibility in addressing load path details which are difficult and complex to adequately address in a prescriptive building code (without making the code more complex than many users are willing to tolerate). In this case, engineering provides a value-added solution. However, to fully realize the value potential of engineering, engineers must be equipped with the same efficient design methodology used by the IRC Ad Hoc Wall Bracing Committee to upgrade the IRC wall bracing provisions. Otherwise, engineering will be non-competitive and resisted by the housing market for no other reason than not having access to the design methods as used to develop the IRC wall bracing provisions. Therefore, this proposal recognizes conventional engineering practices (e.g., IBC and IRC Section 301) and also includes the option to use design consistent with the IRC for buildings within the scope of the IRC. The IRC commentary should be coordinated with the proposal by referencing the following peer-reviewed journal paper explaining the engineering basis of the IRC bracing provisions:

Crandell, J. and Martin, Z., "The Story Behind the 2009 IRC Wall Bracing Provisions (Part 2: New Wind Bracing Requirements)", *Wood Design Focus*, Forest Products Society, Madison, WI, Spring 2009.

Fifth, for special conditions not addressed in the proposed simplified conventional bracing and continuous sheathing methods addressed in this proposal, the existing IRC provisions are listed as one of the accepted means of a bracing design and are placed in Appendix R. The more complex provisions of the IRC should only be required in special cases, realizing that these provisions add significant complexity not necessary for most homes in most states and regions of the US.

Finally, bracing materials and methods in the IRC were evaluated using very specific performance criteria that are not currently made explicit such that innovation is encouraged and competition between incumbent materials and new materials is conducted on a fair and level playing field. Therefore, this proposal includes language to allow equivalency on the basis of equivalent bracing performance, not just a narrow equivalency concept based only on equivalency of materials (e.g., a weaker bracing material should be considered as equivalent when a greater amount is required to provide equivalent bracing performance of a building in end use). While this seems like common sense, it has been a major barrier to innovation, evaluation, acceptance, and fair market competition of alternative means and methods of bracing. This also affects the ability to provide competitive and consistent engineered solutions.

Based on the above points and a clear need to take the IRC wall bracing provisions to the next step to better promote simplicity, affordability, performance, and innovation, your support for approval of this proposal is requested.

Cost Impact: The code change proposal will not increase the cost of construction.

RB329-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R602.10 (NEW)-RB-CRANDELL-LAUTRUP-WAINRIGHT.doc

RB330 – 13
R603, M1308.1, M2101.6, P2603.2

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Revise as follows:

SECTION R603 COLD-FORMED STEEL WALL FRAMING

R603.1 General. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall be in accordance ~~comply~~ with the requirements of this section.

R603.1.1 Applicability limits. The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above *grade plane*. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the ultimate design wind speed ~~of 110~~ is less than 139 miles per hour (62~~49~~ m/s), Exposure Category B or C, and ~~a maximum~~ the ground snow load is less than or equal to ~~of~~ 70 pounds per square foot (3.35 kPa).

R603.1.2 In-line framing. Load-bearing cold-formed steel studs constructed in accordance with Section R603 shall be located in-line with joists, trusses and rafters in accordance with Figure R603.1.2 and the tolerances specified as follows:

1. The maximum tolerance shall be $^3/_4$ inch (19 mm) between the centerline of the horizontal framing member and the centerline of the vertical framing member.
2. Where the centerline of the horizontal framing member and bearing stiffener are located to one side of the centerline of the vertical framing member, the maximum tolerance shall be $^1/_8$ inch (3 mm) between the web of the horizontal framing member and the edge of the vertical framing member.

R603.2 Structural framing. Load-bearing cold-formed steel wall framing members shall be in accordance ~~comply~~ with this section. ~~Figure R603.2(1) and with the dimensional and minimum thickness requirements specified in Tables R603.2(1) and R603.2(2). Tracks shall comply with Figure R603.2(2) and shall have a minimum flange width of~~ $1^{\cancel{1}}/_4$ ~~inches (32 mm).~~

R603.2.1 Material. Load-bearing cold-formed steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of ~~one of the following:~~

~~1. ASTM A 653: Grades 33 and 50 (Class 1 and 3).~~
~~2. ASTM A 792: Grades 33 and 50A.~~
~~3.~~ ASTM A 1003,~~:~~ Structural Grades 33 Type H and 50 Type H.

R603.2.2 Corrosion protection. Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.

R603.2.3 Dimension, thickness and material grade. Load-bearing cold-formed steel wall framing members shall comply with Figure R603.2.3(1) and with the dimensional and thickness requirements specified in Table R603.2.3. Additionally, all c-shaped sections shall have a minimum flange width of 1.625 inches (41 mm) and a maximum flange width of 2 inches (51 mm). The minimum lip size for c-shaped sections shall be 0.5 inches (13 mm). Track sections shall comply with Figure R603.2.3(2) and shall have a minimum flange width of $1^{1}/_{4}$ inches (32 mm). Minimum Grade 33 ksi steel shall be used wherever 33 mil and 43 mil thicknesses are specified. Minimum Grade 50 ksi steel shall be used wherever 54 and 68 mil thicknesses are specified.

R603.2.4 Identification. Load-bearing cold-formed steel framing members shall have a legible *label*, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (MPa).

~~**R603.2.3 Corrosion protection.** Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:~~

~~1. A minimum of G 60 in accordance with ASTM A 653.~~
~~2. A minimum of AZ 50 in accordance with ASTM A 792.~~

FIGURE R603.2.3(1) C-SHAPED SECTION

(Figure remains unchanged)

FIGURE R603.2.3(2) TRACK SECTION

(Figure remains unchanged)

~~TABLE R603.2(1)~~
~~LOAD-BEARING COLD-FORMED STEEL STUD SIZES~~

~~MEMBER DESIGNATION[a]~~	~~WEB DEPTH (inches)~~	~~MINIMUM FLANGE WIDTH (inches)~~	~~MAXIMUM FLANGE WIDTH (inches)~~	~~MINIMUM LIP SIZE (inches)~~
~~350S162-t~~	~~3.5~~	~~1.625~~	~~2~~	~~0.5~~
~~550S162-t~~	~~5.5~~	~~1.625~~	~~2~~	~~0.5~~

~~For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm.~~
~~a. The member designation is defined by the first number representing the member depth in hundredths of an inch "S" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils [See Table R603.2(2)].~~

TABLE R603.2.3
LOAD-BEARING COLD-FORMED STEEL STUD SIZES AND THICKNESSES

MEMBER DESIGNATION[a]	WEB DEPTH (inches)	MINIMUM BASE STEEL THICKNESS mil (inches)
350S162-t	3.5	33 (0.0329), 43 (0.0428), 54 (0.0538)
550S162-t	5.5	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)

For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm.
a. The member designation is defined by the first number representing the member depth in hundredths of an inch "S" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils .

~~TABLE R603.2(2)~~
~~MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS~~

~~DESIGNATION THICKNESS (mils)~~	~~MINIMUM BASE STEEL THICKNESS (inches)~~
~~33~~	~~0.0329~~

~~43~~	~~0.0428~~
~~54~~	~~0.0538~~
~~68~~	~~0.0677~~
~~97~~	~~0.0966~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.~~

R603.2.<u>5</u>~~4~~ Fastening ~~requirements~~. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^1/_2$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C 1513. Structural sheathing shall be attached to cold-formed steel studs with minimum No. 8 self-drilling tapping screws that conform to ASTM C 1513. Screws for attaching structural sheathing to cold-formed steel wall framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^3/_8$ inch (9.5 mm). Gypsum board shall be attached to cold-formed steel wall framing with minimum No. 6 screws conforming to ASTM C 954 or ASTM C 1513 with a bugle head style and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel a minimum of three exposed threads. All fasteners shall have rust inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

~~Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in Table R603.2.4, when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84 mm). When applying the reduction factor, the resulting number of screws shall be rounded up.~~

~~TABLE R603.2.4~~
~~SCREW SUBSTITUTION FACTOR~~

~~SCREW SIZE~~	~~THINNEST CONNECTED STEEL SHEET (mils)~~	
	~~33~~	~~43~~
~~#8~~	~~1.0~~	~~0.67~~
~~#10~~	~~0.93~~	~~0.62~~
~~#12~~	~~0.86~~	~~0.56~~

~~For SI: 1 mil = 0.0254 mm.~~

~~R603.2.5~~ <u>R603.2.6</u> Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing and web hole patching shall be in accordance with this section.

~~R603.2.5.1~~ <u>R603.2.6.1</u> Web holes. Web holes in wall studs and other structural members shall comply with all of the following conditions:

1. Holes shall conform to Figure ~~R603.2.5.1~~ <u>R603.2.6.1</u>;
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Holes shall have a center-to-center spacing of not less than 24 inches (610 mm);
4. Holes shall have a web hole width not greater than 0.5 times the member depth, or $1^1/_2$ inches (38 mm);
5. Holes shall have a web hole length not exceeding $4^1/_2$ inches (114 mm); and
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section ~~R603.2.5.2~~ <u>R603.2.6.2</u>, patched in accordance with Section ~~R603.2.5.3~~ <u>R603.2.6.3</u> or designed in accordance with accepted engineering practice.

FIGURE ~~R603.2.5.1~~ <u>R603.2.6.1 WALL STUD</u> WEB HOLES

(Figure remains unchanged)

~~R603.2.5.2~~ R603.2.6.2 Web hole reinforcing. Web holes in gable endwall studs not conforming to the requirements of Section ~~R603.2.5.1~~ R603.2.6.1 shall be permitted to be reinforced if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shape section with a hole that does not exceed the web hole size limitations of Section ~~R603.2.5.1~~ R603.2.6.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel reinforcing shall be fastened to the web of the receiving member with No.8 screws spaced no more than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (12.7 mm).

~~R603.2.5.3~~ R603.2.6.3 Hole patching. Web holes in wall studs and other structural members not conforming to the requirements in Section ~~R603.2.5.1~~ R603.2.6.1 shall be permitted to be patched in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practice when web holes exceed the following size limits:
   1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or
   1.2. The length of the hole measured along the web exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section ~~R603.2.5.3~~ R603.2.6.3, Item 1 shall be patched with a solid steel plate, stud section or track section in accordance with Figure ~~R603.2.5.3~~ R603.2.6.3. The steel patch shall, as a minimum, be of the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced no more than 1 inch (25.4 mm) center-to-center along the edges of the patch with a minimum edge distance of $^1/_2$ inch (12.7 mm).

FIGURE ~~R603.2.5.3~~ R603.2.6.3 WALL STUD WEB HOLE PATCH

(Figure remains unchanged)

R603.3 Wall construction. All exterior cold-formed steel framed walls and interior load-bearing cold-formed steel framed walls shall be constructed in accordance with the provisions of this section.

R603.3.1 Wall to foundation or floor connection. Cold- formed steel framed walls shall be anchored to foundations or floors in accordance with Table R603.3.1 and Figure R603.3.1(1), R603.3.1(2), ~~or~~ R603.3.1(3) or 603.3.1(4). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Anchor bolts shall extend a minimum of 15 inches (381 mm) into masonry or 7 inches (178 mm) into concrete. Foundation anchor straps shall be permitted, in lieu of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

R603.3.1.1 Gable endwalls. Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Tables R603.3.1.1(1) or R603.3.1.1(2).

TABLE R603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS[a,b]

FRAMING CONDITION			ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY					
			~~85 B~~	~~90~~115 B	~~100~~126 B ~~85~~or 110 C	~~110~~< 139 B ~~90~~ or 115 C	~~100~~126 C	< ~~110~~139 C
Wall bottom track to floor per Figure R603.3.1(1)			~~1-No. 8 screw at 12″ o.c.~~	1-No. 8 screw at 12″ o.c.	1-No. 8 screw at 12″ o.c.	1-No. 8 screw at 12″ o.c.	2-No. 8 screws at 12″ o.c.	2 No. 8 screws at 12″ o.c.
Wall bottom track to foundation per Figure R603.3.1(2)[d]			~~$^1/_2$″ minimum diameter anchor bolt at 6′ o.c.~~	$^1/_2$″ minimum diameter anchor bolt at 6′ o.c.	$^1/_2$″ minimum diameter anchor bolt at 4′ o.c.	$^1/_2$″ minimum diameter anchor bolt at 4′ o.c.	$^1/_2$″ minimum diameter anchor bolt at 4′ o.c.	$^1/_2$″ minimum diameter anchor bolt at 4′ o.c.
Wall bottom track to wood sill per Figure R603.3.1(3)			~~Steel plate spaced at 4′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails~~	Steel plate spaced at 4′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2′ o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
~~Wind uplift connector strength to 16″ stud spacing[c]~~			~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~65 lb per foot of wall length~~
~~Wind uplift connector strength for 24″ stud spacing[c]~~			~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~100 lb per foot of wall length~~
Wind uplift connector strength (lbs) [c, e]	Stud Spacing (in.)	Roof Span (ft)						
	16	24		NR	NR	NR	124	209
		28		NR	NR	62	151	249
		32		NR	NR	79	179	289
		36		NR	NR	94	206	329
		40		NR	61	117	239	374
	24	24		NR	NR	69	186	314
		28		NR	NR	93	227	374
		32		NR	NR	117	268	434
		36		NR	64	141	309	494
		40		NR	92	176	359	562

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 lb = 4.45 N.

a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks (e.g., at door openings or corners). Bolts are to extend a minimum of 15 inches into masonry or 7 inches into concrete.

b. All screw sizes shown are minimum.

c. NR = uplift connector not required.

d. Foundation anchor straps are permitted in place of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

e. See Figure R603.3.1(4) for details.

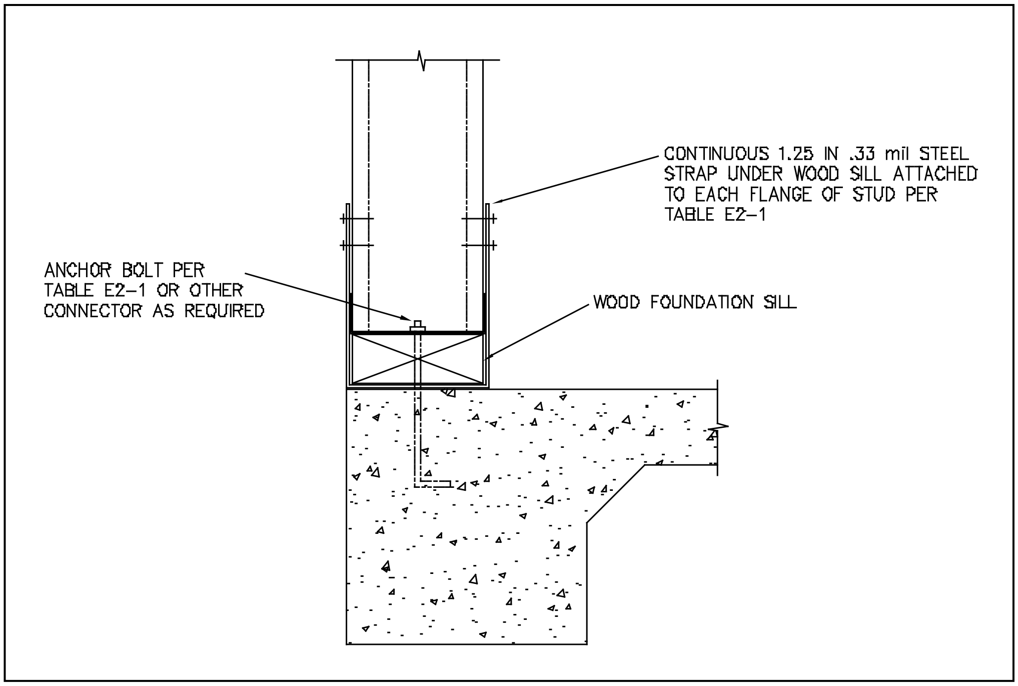


FIGURE R603.3.1(4) WIND UPLIFT CONNECTOR
(Note: New figure. Delete reference to tables.)

TABLE R603.3.1.1(1)
GABLE ENDWALL TO FLOOR CONNECTION REQUIREMENTS[a,b,c]

~~BASIC~~ ULTIMATE WIND SPEED (mph)		WALL BOTTOM TRACK TO FLOOR JOIST OR TRACK CONNECTION		
Exposure Category		Stud height, h (ft)		
B	C	10 < h ≤ 14	14 < h ≤ 18	18 < h ≤ 22
~~85~~	~~-~~	~~1-No. 8 screw @ 12″ o.c.~~	~~1-No. 8 screw @ 12″ o.c.~~	~~1-No. 8 screw @ 12″ o.c.~~
~~90~~115	-	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.
~~100~~126	~~85~~110	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.
~~110~~<139	~~90~~115	1-No. 8 screw @ 12″ o.c.	1-No. 8 screw @ 12″ o.c.	2-No. 8 screws @ 12″ o.c.
-	~~100~~126	1-No. 8 screw @ 12″ o.c.	2-No. 8 screws @ 12″ o.c.	1-No. 8 screw @ 8″ o.c.
-	~~110~~<139	2-No. 8 screws @ 12″ o.c.	1-No. 8 screw @ 8″ o.c.	2-No. 8 screws @ 8″ o.c.

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

a. Refer to Table R603.3.1.1(2) for gable endwall bottom track to foundation connections.
b. Where attachment is not given, special design is required.
c. Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.

TABLE R603.3.1.1(2)
GABLE ENDWALL BOTTOM TRACK TO FOUNDATION CONNECTION REQUIREMENTS[a,b,c]

~~BASIC~~ ULTIMATE WIND SPEED (mph)		MINIMUM SPACING FOR $^1/_2$ IN. DIAMETER ANCHOR BOLTS[d]		
Exposure Category		Stud height, h (ft)		
B	C	10 < h ≤ 14	14 < h ≤ 18	18 < h ≤ 22

~~85~~	~~-~~	~~6′- 0″ o.c.~~	~~6′- 0″ o.c.~~	~~6′- 0″ o.c.~~
~~90~~115	-	6′- 0″ o.c.	5′- 7″ o.c.	6′- 0″ o.c.
~~100~~126	~~85~~110	5′- 10″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
~~110~~<139	~~90~~115	4′- 10″ o.c.	5′- 6″ o.c.	6′- 0″ o.c.
-	~~100~~126	4′- 1″ o.c.	6′- 0″ o.c.	6′- 0″ o.c.
-	~~110~~<139	5′- 1″ o.c.	6′- 0″ o.c.	5′- 2″ o.c.

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.
a. Refer to Table R603.3.1.1(1) for gable endwall bottom track to floor joist or track connection connections.
b. Where attachment is not given, special design is required.
c. Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.
d. Foundation anchor straps are permitted in place of anchor bolts if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

R603.3.2 Minimum stud sizes. Cold-formed steel walls shall be constructed in accordance with Figure R603.3.1(1), R603.3.1(2) or R603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(~~31~~ 16). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(~~31~~ 16) based upon an ultimate design wind speed of ~~85~~115 miles per hour (~~38~~ 51 m/s), Exposure Category ~~A/~~B, ~~wind value~~ and the building width, stud spacing and snow load, as appropriate. Fastening requirements shall be in accordance with Section ~~R603.2.4~~ R603.2.5 and Table R603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs.

Exterior wall studs shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(16~~31~~), but not less than 33 mils (0.84 mm), where both of the following conditions exist:

1. Minimum of $^{1}/_{2}$ inch (12.7 mm) gypsum board is installed and fastened in accordance with Section R702 on the interior surface.
2. Wood structural sheathing panels of minimum $^{7}/_{16}$-inch-thick (11 mm) oriented strand board or $^{15}/_{32}$-inch-thick (12 mm) plywood is installed and fastened in accordance with Section R603.9~~.1~~ and Table R603.3.2(1) on the outside surface.

Interior load-bearing walls shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(~~31~~ 16), but not less than 33 mils (0.84 mm), where a minimum of $^{1}/_{2}$-inch (12.7 mm) gypsum board is installed and fastened in accordance with Section R702 on both sides of the wall. The tabulated stud thickness for load- bearing walls shall be used when the *attic* load is 10 pounds per square feet (480 Pa) or less. A limited *attic* storage load of 20 pounds per square feet (960 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(~~31~~ 16).

For two-story buildings, the tabulated stud thickness for walls supporting one floor, roof and ceiling shall be used when second floor live load is 30 pounds per square feet (1440 Pa). Second floor live loads of 40 psf (1920 pounds per square feet) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(~~21~~ 11).

For three-story buildings, the tabulated stud thickness for walls supporting one or two floors, roof and ceiling shall be used when the third floor live load is 30 pounds per square feet (1440 Pa). Third floor live loads of 40 pounds per square feet (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(~~22~~ 12) through R603.3.2(~~31~~ 16).

R603.3.2.1 Gable endwalls. The size and thickness of gable endwall studs with heights less than or equal to 10 feet (3048 mm) shall be permitted in accordance with the limits set forth in Table R603.3.2.1(1)~~ or R603.3.2.1(2)~~. The size and thickness of gable endwall studs with heights greater than 10 feet (3048 mm) shall be determined in accordance with the limits set forth in Table R603.3.2.1(2~~3~~) ~~or R603.3.2.1(4)~~.

TABLE R603.3.2(1)
WALL FASTENING SCHEDULE[a]

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS[a]	SPACING OF FASTENERS
~~Floor joist to track of load-bearing wall~~	~~2-No. 8 screws~~	~~Each joist~~
Wall stud to top or bottom track	2-No. 8 screws	Each end of stud, one per flange
Structural sheathing to wall studs	No. 8 screws[b]	6″ o.c. on edges and 12″ o.c. at intermediate supports
<u>½” Gypsum board to framing</u>	<u>No. 6 screws</u>	<u>12” o.c.</u>
~~Roof framing to wall~~	~~Approved design or tie down in accordance with Section R802.11~~.	

For SI: 1 inch = 25.4 mm.

a. All screw sizes shown are minimum.

b. Screws for attachment of structural sheathing panels are to be bugle-head, flat-head, or similar head styles with a minimum head diameter of 0.29 inch.

TABLE R603.3.2(2)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	43	43	43
-	~~100~~126~~mph~~	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43
			24	43	43	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
-	~~110~~<139~~mph~~	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43
			24	43	43	43	43	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*

b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(3)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a,b,c] 50 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
100mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
110mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
-	100mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
-	110mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.
a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.

TABLE R603.3.2(34)
28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d] ~~33 ksi STEEL~~

ULTIMATEWIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	~~33~~43	~~33~~43	~~33~~43	43
-	~~100~~126~~mph~~	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	~~33~~43	~~33~~43	~~33~~43	43	~~33~~43	~~33~~43	~~33~~43	43
-	~~110~~<139~~mph~~	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	~~33~~43	~~33~~43	~~33~~43	43	~~33~~43	~~33~~43	~~33~~43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   - Second floor dead load is 10 psf.
   - Second floor live load is 30 psf.
   - Roof/ceiling dead load is 12 psf.
   - Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(5)~~
~~28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY~~[a,b,c] ~~50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
100mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
110mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
-	100mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33
-	110mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~
~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240*.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~6~~ 4)
32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~100~~126 ~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~110~~<139 ~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	~~33~~43	~~33~~43	43	43
-	~~100~~126 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	~~33~~43	~~33~~43	~~33~~43	43	~~33~~43	~~33~~43	43	43
-	~~110~~<139 ~~mph~~	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	~~33~~43	~~33~~43	43	43	~~33~~43	~~33~~43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(7)~~
~~32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
100mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
110mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
-	100mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
-	110mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240*.~~

~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~8~~ 5)
36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d] ~~33 ksi STEEL~~

~~ULTIMATE~~ WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	33	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	43	43	43	43	43	43	54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	~~33~~43	~~33~~43	43	43
-	~~100~~126~~mph~~	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	~~33~~43	~~33~~43	43	43	~~33~~43	~~33~~43	43	43
-	~~110~~<139~~mph~~	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	~~33~~43	~~33~~43	43	54	~~33~~43	33	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
    Second floor dead load is 10 psf.
    Second floor live load is 30 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(9)~~
~~36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a,b,c] 50 ksi STEEL~~

~~WIND SPEED~~		~~MEMBER SIZE~~	~~STUD SPACING (inches)~~	~~MINIMUM STUD THICKNESS (mils)~~											
				~~8-Foot Studs~~				~~9-Foot Studs~~				~~10-Foot Studs~~			
				~~Ground Snow Load (psf)~~											
~~Exp. B~~	~~Exp. C~~			~~20~~	~~30~~	~~50~~	~~70~~	~~20~~	~~30~~	~~50~~	~~70~~	~~20~~	~~30~~	~~50~~	~~70~~
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~90 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~100mph~~	~~85 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~110mph~~	~~90 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~-~~	~~100mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~-~~	~~110mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~
~~1 Ksi = 1,000 psi = 6.895 MPa.~~
~~a. Deflection criterion: *L/240*.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~10~~ 6)
40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a, b, c, d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~54~~	~~43~~	~~43~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	33	33	43	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	33	33	~~33~~43	43
			24	33	43	43	54	33	43	43	54	43	43	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	33	33	43	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	33	43	43	54	43	43	43	54	43	43	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	~~33~~43	~~33~~43	43	54
-	~~100~~126~~mph~~	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	54	~~68~~54	43	43	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	~~33~~43	~~33~~43	43	54	~~33~~43	~~33~~43	43	54
-	~~110~~<139~~mph~~	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	~~68~~54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	~~33~~43	~~33~~43	43	54	~~33~~43	~~33~~43	43	54	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(11)~~

~~40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
100mph	85 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	33	33	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
110mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
-	100mph	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43
-	110mph	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	33	33	43	54	43	43	43	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240*.~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~

~~Second floor live load is 30 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~12~~ 7)
24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	33	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	43	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	43	33	33	33	33	33	33	43	43
			24	43	43	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
-	~~100~~126~~mph~~	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43
-	~~110~~<139~~mph~~	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(13)~~
~~24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
100mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
110mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33
-	100mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43
-	110mph	350S162	16	33	33	33	33	33	33	33	33	33	33	43	43
			24	43	43	43	43	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	43

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~
~~1 Ksi = 1,000 psi = 6.895 MPa.~~
~~a. Deflection criterion: *L/240*.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~14~~ 8)
28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
-	~~100~~126~~mph~~	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	43	43	43	43	43	43	43	43
-	~~110~~<139~~mph~~	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
    Second floor dead load is 10 psf.
    Second floor live load is 30 psf.
    Roof/ceiling dead load is 12 psf.
    Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(15)~~
~~28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
90 mph	-	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
100mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
110mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	33	33	43	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
-	100mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43
			24	43	43	43	54	43	43	43	43	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43
-	110mph	350S162	16	33	33	33	43	33	33	33	33	43	43	43	43
			24	43	43	43	54	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~
~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240*.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~16~~ 9)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33	43	33	33	33	43	33	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	43	43	33	33	33	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	43	43	43	54
-	~~100~~126~~mph~~	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43
			24	43	43	54	54	54	54	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	43	43	43	43	43	43	43	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	~~68~~54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(17)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c] 50 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	33	43
90 mph	-	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	33	43
100mph	85 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	33	43	54	33	33	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	33	43
110mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	33	43
-	100mph	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43
-	110mph	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
 Second floor dead load is 10 psf.
 Second floor live load is 30 psf.
 Roof/ceiling dead load is 12 psf.
 Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.

TABLE R603.3.2(~~18~~ 10)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	43	43	33	33	43	43	33	33	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43
			24	43	43	54	~~68~~54	43	43	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	~~68~~54	54	54	54	54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
-	~~100~~126~~mph~~	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	~~68~~54	54	54	54	~~68~~54	54	~~68~~54	~~68~~54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54
			24	54	54	54	~~68~~54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(19)~~

~~36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
90 mph	-	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	33	33	43	54	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
100mph	85 mph	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
110mph	90 mph	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
-	100mph	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	43	43	43	54	43	43	43	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43
-	110mph	350S162	16	33	33	43	43	33	33	33	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240*.~~

~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~20~~ 11)
40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~68~~	~~43~~	~~43~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	~~68~~54	43	43	54	~~68~~54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	~~68~~54	43	43	54	~~68~~54	54	54	54	~~68~~54
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
-	~~100~~126~~mph~~	350S162	16	43	43	43	54	43	43	43	54	43	43	54	54
			24	54	54	54	~~68~~54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~97~~68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~97~~68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Second floor live load is 30 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(21)~~
~~40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

~~WIND SPEED~~		~~MEMBER SIZE~~	~~STUD SPACING (inches)~~	~~MINIMUM STUD THICKNESS (mils)~~											
				~~8-Foot Studs~~				~~9-Foot Studs~~				~~10-Foot Studs~~			
				~~Ground Snow Load (psf)~~											
~~Exp. B~~	~~Exp. C~~			~~20~~	~~30~~	~~50~~	~~70~~	~~20~~	~~30~~	~~50~~	~~70~~	~~20~~	~~30~~	~~50~~	~~70~~
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~90 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~100mph~~	~~85 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~110mph~~	~~90 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~
~~-~~	~~100mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~43~~	~~43~~	~~43~~
~~-~~	~~110mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~33~~	~~43~~	~~43~~	~~54~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240.*~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~
~~Second floor live load is 30 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(12~~22~~)
24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~43~~	~~33~~	~~33~~	~~33~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~43~~	~~43~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~33~~	~~43~~
			~~24~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	~~68~~54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	~~68~~54	~~68~~54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
-	~~100~~126~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~97~~68
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Top and middle floor dead load is 10 psf
   Top floor live load is 30 psf.
   Middle floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(23)~~
~~24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	54	54	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43
90 mph	-	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	54	54	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43
100mph	85 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	54	54	43	43	43	43	43	43	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43
110mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	43	43
			24	43	43	54	54	43	43	43	43	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43
-	100mph	350S162	16	33	33	33	43	33	33	33	33	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43
-	110mph	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240.*~~

~~b. Design load assumptions:~~

~~Top and middle floor dead load is 10 psf~~

~~Top floor live load is 30 psf.~~

~~Middle floor live load is 40 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~24~~ 13)
28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~68~~
		~~550S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	~~68~~54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	~~68~~54	~~68~~54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
-	~~100~~126~~mph~~	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54
			24	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~97~~68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68	68	~~97~~68	~~97~~68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Top and middle floor dead load is 10 psf
   Top floor live load is 30 psf.
   Middle floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(25)~~
~~28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43
90 mph	-	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43
100mph	85 mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43
110mph	90 mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	43	43	54	54	54	54	54	54
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43
-	100mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43
-	110mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	68	68	68	68
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240.*~~

~~b. Design load assumptions:~~

~~Top and middle floor dead load is 10 psf~~
~~Top floor live load is 30 psf.~~
~~Middle floor live load is 40 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~26~~ 14)
32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	-	~~350S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~54~~	~~54~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
		~~550S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
~~90~~115 ~~mph~~	-	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	~~68~~54	~~68~~54	~~68~~54	68	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	~~68~~54	~~68~~54	~~68~~54	68	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	43	43	43	54	43	43	43	43	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	54	54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	54
-	~~100~~126~~mph~~	350S162	16	43	43	43	54	43	43	43	43	54	54	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	68	68	~~97~~68	~~97~~68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	54
-	~~110~~<139~~mph~~	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	~~68~~54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Top and middle floor dead load is 10 psf
   Top floor live load is 30 psf.
   Middle floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(27)~~

~~32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
90 mph	-	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
100mph	85 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
110mph	90 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
-	100mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
-	110mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~

~~1 Ksi = 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion: *L/240.*~~

~~b. Design load assumptions:~~

~~Top and middle floor dead load is 10 psf~~

~~Top floor live load is 30 psf.~~

~~Middle floor live load is 40 psf.~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~28~~ 15)
36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~43~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~97~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~97~~
		~~550S162~~	~~16~~	~~43~~	~~43~~	~~43~~	~~54~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~	~~43~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~54~~	~~54~~	~~54~~	~~68~~	~~54~~	~~54~~	~~68~~	~~68~~
~~90~~115 ~~mph~~	-	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	~~97~~68	~~68~~54	~~68~~54	~~68~~54	68	68	68	68	~~97~~68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	~~68~~54	~~68~~54	~~68~~54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	~~97~~68	~~68~~54	~~68~~54	~~68~~54	68	68	68	68	~~97~~68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	~~68~~54	~~68~~54	~~68~~54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	54	54	54	54	43	43	43	54	54	54	54	54
			24	68	68	68	~~97~~68	~~68~~54	~~68~~54	~~68~~54	68	68	68	~~97~~68	~~97~~68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	~~68~~54	~~68~~54	~~68~~54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54
-	~~100~~126~~mph~~	350S162	16	54	54	54	54	43	43	54	54	54	54	54	54
			24	68	68	68	~~97~~68	~~68~~54	~~68~~54	~~68~~54	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	~~68~~54	~~68~~54	~~68~~54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54
-	~~110~~<139~~mph~~	350S162	16	54	54	54	54	54	54	54	54	54	54	54	68
			24	68	68	68	~~97~~68	~~68~~54	~~68~~54	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	~~68~~54	~~68~~54	~~68~~54	~~68~~54	54	54	54	~~68~~54	54	54	~~68~~54	~~68~~54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.
1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*
b. Design load assumptions:
   Top and middle floor dead load is 10 psf
   Top floor live load is 30 psf.
   Middle floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the wall studs.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2(29)~~
~~36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
90 mph	-	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
100mph	85 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
110mph	90 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
-	100mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54
			24	68	68	68	68	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
-	110mph	350S162	16	43	43	43	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	54	54	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

~~For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.~~
~~1 Ksi = 1,000 psi = 6.895 MPa.~~
~~a. Deflection criterion: *L/240*.~~
~~b. Design load assumptions:~~
~~Top and middle floor dead load is 10 psf~~
~~Top floor live load is 30 psf.~~
~~Middle floor live load is 40 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the wall studs.~~

TABLE R603.3.2(~~30~~ 16)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
~~Exp.~~ B	~~Exp.~~ C			20	30	50	70	20	30	50	70	20	30	50	70
~~85 mph~~	-	~~350S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~	~~54~~
			~~24~~	~~97~~	~~97~~	~~97~~	~~97~~	~~68~~	~~68~~	~~68~~	~~97~~	~~97~~	~~97~~	~~97~~	~~97~~
		~~550S162~~	~~16~~	~~54~~	~~54~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~	~~43~~	~~43~~	~~54~~	~~54~~
			~~24~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~	~~68~~
~~90~~115 ~~mph~~	-	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	~~97~~68	~~97~~68	~~97~~68	~~97~~68	68	68	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	~~97~~68	~~97~~68	~~97~~68	~~97~~68	68	68	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	~~97~~68	~~97~~68	~~97~~68	~~97~~68	68	68	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
-	~~100~~126~~mph~~	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	~~97~~68	~~97~~68	~~97~~68	~~97~~68	68	68	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54
-	~~110~~<139~~mph~~	350S162	16	54	54	54	54	54	54	54	54	54	54	~~68~~54	~~68~~54
			24	~~97~~68	~~97~~68	~~97~~68	~~97~~68	68	68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	~~97~~68	---~~97~~
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	~~68~~54	~~68~~54	~~68~~54	68	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54	~~68~~54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*

b. Design load assumptions:
   - Top and middle floor dead load is 10 psf
   - Top floor live load is 30 psf.
   - Middle floor live load is 40 psf.
   - Roof/ceiling dead load is 12 psf.
   - Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(31)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING[a,b,c] 50 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
Exp. B	Exp. C			20	30	50	70	20	30	50	70	20	30	50	70
85 mph	-	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54
90 mph	-	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54
100mph	85 mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54
110mph	90 mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54
-	100mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54
-	110mph	350S162	16	54	54	54	54	43	43	43	43	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	97
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot – 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour – 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

1 Ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: *L/240.*

b. Design load assumptions:
   Top and middle floor dead load is 10 psf
   Top floor live load is 30 psf.
   Middle floor live load is 40 psf.
   Roof/ceiling dead load is 12 psf.
   Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

TABLE R603.3.2.1(1)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)		
~~Exp.~~ B	~~Exp.~~ C			8-foot studs	9-foot studs	10-foot studs
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~90~~115 ~~mph~~	-	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
~~100~~126~~mph~~	~~85~~110 ~~mph~~	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
~~110~~<139~~mph~~	~~90~~115 ~~mph~~	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
-	~~100~~126~~mph~~	350S162	16	33	33	43
			24	43	43	54
		550S162	16	33	33	33
			24	33	33	33
-	~~110~~<139~~mph~~	350S162	16	33	43	43
			24	43	54	54
		550S162	16	33	33	33
			24	33	33	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 Ksi – 1,000 psi = 6.895 MPa.

a. Deflection criterion *L/240.*

b. Design load assumptions:
    Ground snow load is 70 psf.
    Roof/ceiling dead load is 12 psf.
    Floor dead load is 10 psf.
    Floor live load is 40 psf.
    Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2.1(2)~~
~~ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT~~[a,b,c] ~~50 ksi STEEL~~

~~WIND SPEED~~		~~MEMBER SIZE~~	~~STUD SPACING (inches)~~	~~MINIMUM STUD THICKNESS (Mils)~~		
~~Exp. B~~	~~Exp. C~~			~~8-foot studs~~	~~9-foot studs~~	~~10-foot studs~~
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~90 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~100mph~~	~~85 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~110mph~~	~~90 mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~-~~	~~100mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~43~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~
~~-~~	~~110mph~~	~~350S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~43~~	~~54~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~
			~~24~~	~~33~~	~~33~~	~~33~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 Ksi – 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion *L/240*.~~

~~b. Design load assumptions:~~
~~Ground snow load is 70 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Floor dead load is 10 psf.~~
~~Floor live load is 40 psf.~~
~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs~~

TABLE R603.3.2.1(2~~3~~)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT[a,b,c,d] ~~33 ksi STEEL~~

ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)					
				Stud Height, h (feet)					
~~Exp.~~ B	~~Exp.~~ C			10 < h ≤ 12	12 < h ≤ 14	14 < h ≤ 16	16 < h ≤ 18	18 < h ≤ 20	20 < h ≤ 22
~~85 mph~~	~~-~~	~~350S162~~	~~16~~	~~33~~	~~43~~	~~54~~	~~97~~	~~-~~	~~-~~
			~~24~~	~~43~~	~~54~~	~~97~~	~~-~~	~~-~~	~~-~~
		~~550S162~~	~~16~~	~~33~~	~~33~~	~~33~~	~~43~~	~~43~~	~~54~~
			~~24~~	~~33~~	~~33~~	~~43~~	~~54~~	~~68~~	~~97~~
~~90~~115 ~~mph~~	-	350S162	16	33	43	68	---~~97~~	-	-
			24	43	68	---~~97~~	-	-	-
		550S162	16	33	33	33	43	54	54
			24	33	33	43	54	68	---~~97~~
~~100~~126 ~~mph~~	~~85~~110 ~~mph~~	350S162	16	43	54	---~~97~~	-	-	-
			24	54	---~~97~~	-	-	-	-
		550S162	16	33	33	43	54	54	68
			24	33	43	54	~~68~~54	---~~97~~	---~~97~~
~~110~~<139 ~~mph~~	~~90~~115 ~~mph~~	350S162	16	43	68	-	-	-	-
			24	68	-	-	-	-	-
		550S162	16	33	43	43	54	68	---~~97~~
			24	43	54	~~68~~54	~~97~~68	---~~97~~	-
-	~~100~~126~~mph~~	350S162	16	54	---~~97~~	-	-	-	-
			24	---~~97~~	-	-	-	-	-
		550S162	16	33	43	54	~~68~~54	---~~97~~	-
			24	43	~~68~~54	54~~97~~	---~~97~~	-	-
-	~~110~~<139 ~~mph~~	350S162	16	~~68~~54	---~~97~~	-	-	-	-
			24	---~~97~~	-	-	-	-	-
		550S162	16	43	54	~~68~~54	~~97~~68	---~~97~~	-
			24	54	~~68~~54	~~97~~68	-	-	-

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 Ksi – 1,000 psi = 6.895 MPa.

a. Deflection criterion *L/240.*

b. Design load assumptions:
   - Ground snow load is 70 psf.
   - Roof/ceiling dead load is 12 psf.
   - Floor dead load is 10 psf.
   - Floor live load is 40 psf.
   - Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.3.2.1(4)~~

~~ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT[a,b,c] 50 ksi STEEL~~

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)					
				Stud Height, h (feet)					
Exp. B	Exp. C			10 < h ≤ 12	12 < h ≤ 14	14 < h ≤ 16	16 < h ≤ 18	18 < h	20 < h ≤ 22
85 mph	-	350S162	16	33	43	54	97	-	-
			24	33	54	97	-	-	-
		550S162	16	33	33	33	33	43	54
			24	33	33	33	43	54	97
90 mph	-	350S162	16	33	43	68	97	-	-
			24	43	68	97	-	-	-
		550S162	16	33	33	33	33	43	54
			24	33	33	43	43	68	97
100mph	85 mph	350S162	16	33	54	97	-	-	-
			24	54	97	-	-	-	-
		550S162	16	33	33	33	43	54	68
			24	33	33	43	54	97	97
110mph	90 mph	350S162	16	43	68	-	-	-	-
			24	68	-	-	-	-	-
		550S162	16	33	33	43	43	68	97
			24	33	43	54	68	97	-
-	100mph	350S162	16	54	97	-	-	-	-
			24	97	-	-	-	-	-
		550S162	16	33	33	43	54	97	-
			24	43	54	54	97	-	-
-	110mph	350S162	16	54	97	-	-	-	-
			24	97	-	-	-	-	-
		550S162	16	33	43	54	68	97	-
			24	43	54	68	97	-	-

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 Ksi – 1,000 psi = 6.895 MPa.~~

~~a. Deflection criterion *L/240.*~~

~~b. Design load assumptions:~~

~~Ground snow load is 70 psf.~~
~~Roof/ceiling dead load is 12 psf.~~
~~Floor dead load is 10 psf.~~
~~Floor live load is 40 psf.~~
~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the wall studs~~

R603.3.3 Stud bracing. The flanges of cold-formed steel studs shall be laterally braced in accordance with one of the following:

1. Gypsum board on both sides, structural sheathing on both sides, or gypsum board on one side and structural sheathing on the other side of load-bearing walls with gypsum board installed with minimum No. 6 screws in accordance with Section R702 and structural sheathing installed in accordance with Section R603.9~~.1~~ and Table R603.3.2(1).
2. Horizontal steel straps fastened in accordance with Figure R603.3.3(1) on both sides at mid-height for 8-foot (2438 mm) walls, and at one-third points for 9-foot and 10-foot (2743 mm and 3048 mm) walls. Horizontal steel straps shall be at least 1.5 inches in width and 33 mils in thickness (38 mm by 0.84 mm). Straps shall be attached to the flanges of studs with one No. 8 screw. In-line blocking shall be installed between studs at the termination of all straps and at 12 foot (3658 mm) intervals along the strap. Straps shall be fastened to the blocking with two No. 8 screws.
3. Sheathing on one side and strapping on the other side fastened in accordance with Figure R603.3.3(2). Sheathing shall be installed in accordance with Item 1. Steel straps shall be installed in accordance with Item 2.

R603.3.4 Cutting and notching. Flanges and lips of cold-formed steel studs and headers shall not be cut or notched.

R603.3.5 Splicing. Steel studs and other structural members shall not be spliced. Tracks shall be spliced in accordance with Figure R603.3.5.

R603.4 Corner framing. In exterior walls, corner studs and the top tracks shall be installed in accordance with Figure R603.4.

R603.5 Exterior wall covering. The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.

R603.6 Headers. Headers shall be installed above all wall openings in exterior walls and interior load-bearing walls. Box beam headers and back-to-back headers each shall be formed from two equal sized C-shaped members in accordance with Figures R603.6(1) and R603.6(2), respectively, and Tables R603.6(1) through R603.6(~~24~~6). L-shaped headers shall be permitted to be constructed in accordance with AISI S230. Alternately, headers shall be permitted to be designed and constructed in accordance with AISI S100, Section D4.

R603.6.1 Headers in gable endwalls. Box beam and back-to-back headers in gable endwalls shall be permitted to be constructed in accordance with Section R603.6 or with the header directly above the opening in accordance with Figures R603.6.1(1) and R603.6.1(2) and the following provisions:

1. Two 362S162-33 for openings less than or equal to 4 feet (1219 mm).
2. Two 600S162-43 for openings greater than 4 feet (1219 mm) but less than or equal to 6 feet (1830 mm).
3. Two 800S162-54 for openings greater than 6 feet (1829 mm) but less than or equal to 9 feet (2743 mm).

~~TABLE R603.6(1)~~
~~BOX-BEAM HEADER SPANS~~
~~Headers Supporting Roof and Ceiling Only 33 ksi steel~~[~~a, b~~]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width~~[~~c~~] ~~(feet)~~					~~Building width~~[~~c~~] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~

~~2-350S162-33~~	~~3′-3″~~	~~2′-8″~~	~~2′-2″~~	~~-~~	~~-~~	~~2′-8″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~4′-2″~~	~~3′-9″~~	~~3′-4″~~	~~2′-11″~~	~~2′-7″~~	~~3′-9″~~	~~3′-4″~~	~~2′-11″~~	~~2′-7″~~	~~2′-2″~~
~~2-350S162-54~~	~~5′-0″~~	~~4′-6″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~4′-6″~~	~~4′-1″~~	~~3′-8″~~	~~3′-3″~~	~~3′-0″~~
~~2-350S162-68~~	~~5′-7″~~	~~5′-1″~~	~~4′-7″~~	~~4′-3″~~	~~3′-10″~~	~~5′-1″~~	~~4′-7″~~	~~4′-2″~~	~~3′-10″~~	~~3′-5″~~
~~2-350S162-97~~	~~7′-1″~~	~~6′-6″~~	~~6′-1″~~	~~5′-8″~~	~~5′-3″~~	~~6′-7″~~	~~6′-1″~~	~~5′-7″~~	~~5′-3″~~	~~4′-11″~~
~~2-550S162-33~~	~~4′-8″~~	~~4′-0″~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~	~~4′-1″~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~	~~-~~
~~2-550S162-43~~	~~6′-0″~~	~~5′-4″~~	~~4′-10″~~	~~4′-4″~~	~~3′-11″~~	~~5′-5″~~	~~4′-10″~~	~~4′-4″~~	~~3′-10″~~	~~3′-5″~~
~~2-550S162-54~~	~~7′-0″~~	~~6′-4″~~	~~5′-9″~~	~~5′-4″~~	~~4′-10″~~	~~6′-5″~~	~~5′-9″~~	~~5′-3″~~	~~4′-10″~~	~~4′-5″~~
~~2-550S162-68~~	~~8′-0″~~	~~7′-4″~~	~~6′-9″~~	~~6′-3″~~	~~5′-10″~~	~~7′-5″~~	~~6′-9″~~	~~6′-3″~~	~~5′-9″~~	~~5′-4″~~
~~2-550S162-97~~	~~9′-11″~~	~~9′-2″~~	~~8′-6″~~	~~8′-0″~~	~~7′-6″~~	~~9′-3″~~	~~8′-6″~~	~~8′-0″~~	~~7′-5″~~	~~7′-0″~~
~~2-800S162-33~~	~~4′-5″~~	~~3′-11″~~	~~3′-5″~~	~~3′-1″~~	~~2′-10″~~	~~3′-11″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-3″~~
~~2-800S162-43~~	~~7′-3″~~	~~6′-7″~~	~~5′-11″~~	~~5′-4″~~	~~4′-10″~~	~~6′-7″~~	~~5′-11″~~	~~5′-4″~~	~~4′-9″~~	~~4′-3″~~
~~2-800S162-54~~	~~8′-10″~~	~~8′-0″~~	~~7′-4″~~	~~6′-9″~~	~~6′-2″~~	~~8′-1″~~	~~7′-4″~~	~~6′-8″~~	~~6′-1″~~	~~5′-7″~~
~~2-800S162-68~~	~~10′-5″~~	~~9′-7″~~	~~8′-10″~~	~~8′-2″~~	~~7′-7″~~	~~9′-8″~~	~~8′-10″~~	~~8′-1″~~	~~7′-6″~~	~~7′-0″~~
~~2-800S162-97~~	~~13′-1″~~	~~12′-1″~~	~~11′-3″~~	~~10′-7″~~	~~10′-0″~~	~~12′-2″~~	~~11′-4″~~	~~10′-6″~~	~~10′-0″~~	~~9′-4″~~
~~2-1000S162-43~~	~~7′-10″~~	~~6′-10″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~6′-11″~~	~~6′-1″~~	~~5′-5″~~	~~4′-11″~~	~~4′-6″~~
~~2-1000S162-54~~	~~10′-0″~~	~~9′-1″~~	~~8′-3″~~	~~7′-7″~~	~~7′-0″~~	~~9′-2″~~	~~8′-4″~~	~~7′-7″~~	~~6′-11″~~	~~6′-4″~~
~~2-1000S162-68~~	~~11′-11″~~	~~10′-11″~~	~~10′-1″~~	~~9′-4″~~	~~8′-8″~~	~~11′-0″~~	~~10′-1″~~	~~9′-3″~~	~~8′-7″~~	~~8′-0″~~
~~2-1000S162-97~~	~~15′-3″~~	~~14′-3″~~	~~13′-5″~~	~~12′-6″~~	~~11′-10″~~	~~14′-4″~~	~~13′-5″~~	~~12′-6″~~	~~11′-9″~~	~~11′-0″~~
~~2-1200S162-54~~	~~11′-1″~~	~~10′-0″~~	~~9′-2″~~	~~8′-5″~~	~~7′-9″~~	~~10′-1″~~	~~9′-2″~~	~~8′-4″~~	~~7′-7″~~	~~7′-0″~~
~~2-1200S162-68~~	~~13′-3″~~	~~12′-1″~~	~~11′-2″~~	~~10′-4″~~	~~9′-7″~~	~~12′-3″~~	~~11′-2″~~	~~10′-3″~~	~~9′-6″~~	~~8′-10″~~
~~2-1200S162-97~~	~~16′-8″~~	~~15′-7″~~	~~14′-8″~~	~~13′-11″~~	~~13′-3″~~	~~15′-8″~~	~~14′-8″~~	~~13′-11″~~	~~13′-2″~~	~~12′-6″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(1)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof andCeiling Only, a,b,d

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	3′-3″	2′-8″	2′-2″	-	-	2′-8″	2′-2″	-	-	-
2-350S162-43	4′-2″	3′-9″	3′-4″	2′-11″	2′-7″	3′-9″	3′-4″	2′-11″	2′-7″	2′-2″
2-350S162-54	6′-2″	5′-10″	5′-8″	5′-3″	4′-10″	5′-11″	5′-8″	5′-2″	4′-10″	4′-6″
2-350S162-68	6′-7″	6′-3″	6′-0″	5′-10″	5′-8″	6′-4″	6′-1″	5′-10″	5′-8″	5′-6″
2-550S162-33	4′-8″	4′-0″	3′-6″	3′-0″	2′-6″	4′-1″	3′-6″	3′-0″	2′-6″	-
2-550S162-43	6′-0″	5′-4″	4′-10″	4′-4″	3′-11″	5′-5″	4′-10″	4′-4″	3′-10″	3′-5″
2-550S162-54	8′-9″	8′-5″	8′-1″	7′-9″	7′-3″	8′-6″	8′-1″	7′-8″	7′-2″	6′-8″
2-550S162-68	9′-5″	9′-0″	8′-8″	8′-4″	8′-1″	9′-1″	8′-8″	8′-4″	8′-1″	7′-10″
2-800S162-33	4′-5″	3′-11″	3′-5″	3′-1″	2′-10″	3′-11″	3′-6″	3′-1″	2′-9″	2′-3″
2-800S162-43	7′-3″	6′-7″	5′-11″	5′-4″	4′-10″	6′-7″	5′-11″	5′-4″	4′-9″	4′-3″
2-800S162-54	10′-10″	10′-2″	9′-7″	9′-0″	8′-5″	10′-2″	9′-7″	8′-11″	8′-4″	7′-9″
2-800S162-68	12′-8″	11′-10″	11′-2″	10′-7″	10′-1″	11′-11″	11′-2″	10′-7″	10′-0″	9′-6″
2-1000S162-43	7′-10″	6′-10″	6′-1″	5′-6″	5′-0″	6′-11″	6′-1″	5′-5″	4′-11″	4′-6″
2-1000S162-54	12′-3″	11′-5″	10′-9″	10′-2″	9′-6″	11′-6″	10′-9″	10′-1″	9′-5″	8′-9″
2-1000S162-68	14′-5″	13′-5″	12′-8″	12′-0″	11′-6″	13′-6″	12′-8″	12′-0″	11′-5″	10′-10″

2-1200S162-54	12′-11″	11′-3″	10′-0″	9′-0″	8′-2″	11′-5″	10′-0″	9′-0″	8′-1″	7′-4″
2-1200S162-68	15′-11″	14′-10″	14′-0″	13′-4″	12′-8″	15′-0″	14′-0″	13′-3″	12′-7″	11′-11″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Roof/Ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(2)~~

~~BOX-BEAM HEADER SPANS Headers Supporting Roof and Ceiling Only (50 ksi steel)~~~~[a, b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width~~~~[c]~~ ~~(feet)~~					~~Building width~~~~[c]~~ ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~4′-4″~~	~~3′-11″~~	~~3′-6″~~	~~3′-2″~~	~~2′-10″~~	~~3′-11″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-5″~~
~~2-350S162-43~~	~~5′-6″~~	~~5′-0″~~	~~4′-7″~~	~~4′-2″~~	~~3′-10″~~	~~5′-0″~~	~~4′-7″~~	~~4′-2″~~	~~3′-10″~~	~~3′-6″~~
~~2-350S162-54~~	~~6′-2″~~	~~5′-10″~~	~~5′-8″~~	~~5′-3″~~	~~4′-10″~~	~~5′-11″~~	~~5′-8″~~	~~5′-2″~~	~~4′-10″~~	~~4′-6″~~
~~2-350S162-68~~	~~6′-7″~~	~~6′-3″~~	~~6′-0″~~	~~5′-10″~~	~~5′-8″~~	~~6′-4″~~	~~6′-1″~~	~~5′-10″~~	~~5′-8″~~	~~5′-6″~~
~~2-350S162-97~~	~~7′-3″~~	~~6′-11″~~	~~6′-8″~~	~~6′-5″~~	~~6′-3″~~	~~7′-0″~~	~~6′-8″~~	~~6′-5″~~	~~6′-3″~~	~~6′-0″~~
~~2-550S162-33~~	~~6′-2″~~	~~5′-6″~~	~~5′-0″~~	~~4′-7″~~	~~4′-2″~~	~~5′-7″~~	~~5′-0″~~	~~4′-6″~~	~~4′-1″~~	~~3′-8″~~
~~2-550S162-43~~	~~7′-9″~~	~~7′-2″~~	~~6′-7″~~	~~6′-1″~~	~~5′-8″~~	~~7′-3″~~	~~6′-7″~~	~~6′-1″~~	~~5′-7″~~	~~5′-2″~~
~~2-550S162-54~~	~~8′-9″~~	~~8′-5″~~	~~8′-1″~~	~~7′-9″~~	~~7′-3″~~	~~8′-6″~~	~~8′-1″~~	~~7′-8″~~	~~7′-2″~~	~~6′-8″~~
~~2-550S162-68~~	~~9′-5″~~	~~9′-0″~~	~~8′-8″~~	~~8′-4″~~	~~8′-1″~~	~~9′-1″~~	~~8′-8″~~	~~8′-4″~~	~~8′-1″~~	~~7′-10″~~
~~2-550S162-97~~	~~10′-5″~~	~~10′-0″~~	~~9′-7″~~	~~9′-3″~~	~~9′-0″~~	~~10′-0″~~	~~9′-7″~~	~~9′-3″~~	~~8′-11″~~	~~8′-8″~~
~~2-800S162-33~~	~~4′-5″~~	~~3′-11″~~	~~3′-5″~~	~~3′-1″~~	~~2′-10″~~	~~3′-11″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-6″~~
~~2-800S162-43~~	~~9′-1″~~	~~8′-5″~~	~~7′-8″~~	~~6′-11″~~	~~6′-3″~~	~~8′-6″~~	~~7′-8″~~	~~6′-10″~~	~~6′-2″~~	~~5′-8″~~
~~2-800S162-54~~	~~10′-10″~~	~~10′-2″~~	~~9′-7″~~	~~9′-0″~~	~~8′-5″~~	~~10′-2″~~	~~9′-7″~~	~~8′-11″~~	~~8′-4″~~	~~7′-9″~~
~~2-800S162-68~~	~~12′-8″~~	~~11′-10″~~	~~11′-2″~~	~~10′-7″~~	~~10′-1″~~	~~11′-11″~~	~~11′-2″~~	~~10′-7″~~	~~10′-0″~~	~~9′-6″~~
~~2-800S162-97~~	~~14′-2″~~	~~13′-6″~~	~~13′-0″~~	~~12′-7″~~	~~12′-2″~~	~~13′-8″~~	~~13′-1″~~	~~12′-7″~~	~~12′-2″~~	~~11′-9″~~
~~2-1000S162-43~~	~~7′-10″~~	~~6′-10″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~6′-11″~~	~~6′-1″~~	~~5′-5″~~	~~4′-11″~~	~~4′-6″~~
~~2-1000S162-54~~	~~12′-3″~~	~~11′-5″~~	~~10′-9″~~	~~10′-2″~~	~~9′-6″~~	~~11′-6″~~	~~10′-9″~~	~~10′-1″~~	~~9′-5″~~	~~8′-9″~~
~~2-1000S162-68~~	~~14′-5″~~	~~13′-5″~~	~~12′-8″~~	~~12′-0″~~	~~11′-6″~~	~~13′-6″~~	~~12′-8″~~	~~12′-0″~~	~~11′-5″~~	~~10′-10″~~
~~2-1000S162-97~~	~~17′-1″~~	~~16′-4″~~	~~15′-8″~~	~~14′-11″~~	~~14′-3″~~	~~16′-5″~~	~~15′-9″~~	~~14′-10″~~	~~14′-1″~~	~~13′-6″~~
~~2-1200S162-54~~	~~12′-11″~~	~~11′-3″~~	~~10′-0″~~	~~9′-0″~~	~~8′-2″~~	~~11′-5″~~	~~10′-0″~~	~~9′-0″~~	~~8′-1″~~	~~7′-4″~~
~~2-1200S162-68~~	~~15′-11″~~	~~14′-10″~~	~~14′-0″~~	~~13′-4″~~	~~12′-8″~~	~~15′-0″~~	~~14′-0″~~	~~13′-3″~~	~~12′-7″~~	~~11′-11″~~
~~2-1200S162-97~~	~~19′-11″~~	~~18′-7″~~	~~17′-6″~~	~~16′-8″~~	~~15′-10″~~	~~18′-9″~~	~~17′-7″~~	~~16′-7″~~	~~15′-9″~~	~~15′-0″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Roof/Ceiling dead load is 12 psf.~~

~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(3)~~
~~BOX-BEAM SPANS~~
~~Headers Supporting Roof and Ceiling Only 33 ksi steel[a, b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~2′-4″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~3′-1″~~	~~2′-8″~~	~~2′-3″~~	~~-~~	~~-~~	~~2′-1″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-68~~	~~3′-7″~~	~~3′-2″~~	~~2′-8″~~	~~2′-3″~~	~~-~~	~~2′-6″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-97~~	~~5′-1″~~	~~4′-7″~~	~~4′-3″~~	~~3′-11″~~	~~3′-7″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~3′-0″~~	~~2′-8″~~
~~2-550S162-33~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~3′-8″~~	~~3′-1″~~	~~2′-6″~~	~~-~~	~~-~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-54~~	~~4′-7″~~	~~4′-0″~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~	~~3′-3″~~	~~2′-8″~~	~~2′-1″~~	~~-~~	~~-~~
~~2-550S162-68~~	~~5′-6″~~	~~4′-11″~~	~~4′-5″~~	~~3′-11″~~	~~3′-6″~~	~~4′-3″~~	~~3′-8″~~	~~3′-1″~~	~~2′-7″~~	~~2′-1″~~
~~2-550S162-97~~	~~7′-3″~~	~~6′-7″~~	~~6′-1″~~	~~5′-8″~~	~~5′-3″~~	~~5′-11″~~	~~5′-4″~~	~~4′-11″~~	~~4′-6″~~	~~4′-1″~~
~~2-800S162-33~~	~~2′-7″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-43~~	~~4′-6″~~	~~3′-9″~~	~~3′-1″~~	~~2′-5″~~	~~-~~	~~2′-10″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-54~~	~~5′-10″~~	~~5′-1″~~	~~4′-6″~~	~~3′-11″~~	~~3′-4″~~	~~4′-3″~~	~~3′-6″~~	~~2′-9″~~	~~-~~	~~-~~
~~2-800S162-68~~	~~7′-2″~~	~~6′-6″~~	~~5′-10″~~	~~5′-3″~~	~~4′-8″~~	~~5′-7″~~	~~4′-10″~~	~~4′-2″~~	~~3′-7″~~	~~2′-11″~~
~~2-800S162-97~~	~~9′-7″~~	~~8′-9″~~	~~8′-2″~~	~~7′-7″~~	~~7′-0″~~	~~7′-11″~~	~~7′-2″~~	~~6′-7″~~	~~6′-0″~~	~~5′-7″~~
~~2-1000S162-43~~	~~4′-8″~~	~~4′-1″~~	~~3′-6″~~	~~2′-9″~~	~~-~~	~~3′-3″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~
~~2-1000S162-54~~	~~6′-7″~~	~~5′-10″~~	~~5′-1″~~	~~4′-5″~~	~~3′-9″~~	~~4′-10″~~	~~4′-0″~~	~~3′-2″~~	~~2′-3″~~	~~-~~
~~2-1000S162-68~~	~~8′-3″~~	~~7′-5″~~	~~6′-8″~~	~~6′-0″~~	~~5′-5″~~	~~6′-5″~~	~~5′-7″~~	~~4′-9″~~	~~4′-1″~~	~~3′-5″~~
~~2-1000S162-97~~	~~11′-4″~~	~~10′-5″~~	~~9′-8″~~	~~9′-0″~~	~~8′-5″~~	~~9′-5″~~	~~8′-6″~~	~~7′-10″~~	~~7′-2″~~	~~6′-7″~~
~~2-1200S162-54~~	~~7′-3″~~	~~6′-5″~~	~~5′-7″~~	~~4′-10″~~	~~4′-2″~~	~~5′-4″~~	~~4′-4″~~	~~3′-5″~~	~~2′-5″~~	~~-~~
~~2-1200S162-68~~	~~9′-2″~~	~~8′-2″~~	~~7′-5″~~	~~6′-8″~~	~~6′-0″~~	~~7′-1″~~	~~6′-2″~~	~~5′-4″~~	~~4′-6″~~	~~3′-9″~~
~~2-1200S162-97~~	~~12′-10″~~	~~11′-9″~~	~~10′-11″~~	~~10′-2″~~	~~9′-6″~~	~~10′-7″~~	~~9′-8″~~	~~8′-10″~~	~~8′-2″~~	~~7′-6″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Attic dead load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(2)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only[, a,b,d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	2′-4″	-	-	-	-	-	-	-	-	-
2-350S162-54	4′-8″	4′-2″	3′-9″	3′-5″	3′-1″	3′-7″	3′-2″	2′-9″	2′-5″	2′-0″
2-350S162-68	5′-7″	5′-2″	4′-9″	4′-4″	3′-11″	4′-7″	4′-1″	3′-7″	3′-2″	2′-10″
2-550S162-33	2′-2″	-	-	-	-	-	-	-	-	-

2-550S162-43	3′-8″	3′-1″	2′-6″	-	-	2′-3″	-	-	-	-
2-550S162-54	6′-11″	6′-3″	5′-9″	5′-3″	4′-9″	5′-6″	4′-11″	4′-5″	3′-11″	3′-5″
2-550S162-68	8′-0″	7′-6″	6′-11″	6′-5″	5′-11″	6′-9″	6′-1″	5′-6″	5′-0″	4′-7″
2-800S162-33	2′-7″	-	-	-	-	-	-	-	-	-
2-800S162-43	4′-6″	3′-9″	3′-1″	2′-5″	-	2′-10″	-	-	-	-
2-800S162-54	8′-0″	7′-3″	6′-8″	6′-1″	5′-7″	6′-5″	5′-9″	5′-1″	4′-7″	4′-0″
2-800S162-68	9′-9″	9′-0″	8′-3″	7′-8″	7′-1″	8′-0″	7′-3″	6′-7″	6′-0″	5′-6″
2-1000S162-43	4′-8″	4′-1″	3′-6″	2′-9″	-	3′-3″	2′-2″	-	-	-
2-1000S162-54	9′-1″	8′-2″	7′-3″	6′-7″	6′-0″	7′-0″	6′-2″	5′-6″	5′-0″	4′-6″
2-1000S162-68	11′-1″	10′-2″	9′-5″	8′-8″	8′-1″	9′-1″	8′-3″	7′-6″	6′-10″	6′-3″
2-1200S162-54	7′-8″	6′-9″	6′-1″	5′-6″	5′-0″	5′-10″	5′-1″	4′-7″	4′-1″	3′-9″
2-1200S162-68	12′-3″	11′-3″	10′-4″	9′-7″	8′-11″	10′-1″	9′-1″	8′-3″	7′-6″	6′-10″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Roof/Ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(4)~~

~~BOX-BEAM HEADER SPANS Headers Supporting Roof and Ceiling Only~~

~~(50 ksi steel)~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~2′-7″~~	~~2′-2″~~	-	-	-	-	-	-	-	-
~~2-350S162-43~~	~~3′-8″~~	~~3′-3″~~	~~2′-10″~~	~~2′-6″~~	~~2′-1″~~	~~2′-8″~~	~~2′-3″~~	-	-	-
~~2-350S162-54~~	~~4′-8″~~	~~4′-2″~~	~~3′-9″~~	~~3′-5″~~	~~3′-1″~~	~~3′-7″~~	~~3′-2″~~	~~2′-9″~~	~~2′-5″~~	~~2′-0″~~
~~2-350S162-68~~	~~5′-7″~~	~~5′-2″~~	~~4′-9″~~	~~4′-4″~~	~~3′-11″~~	~~4′-7″~~	~~4′-1″~~	~~3′-7″~~	~~3′-2″~~	~~2′-10″~~
~~2-350S162-97~~	~~6′-2″~~	~~5′-11″~~	~~5′-8″~~	~~5′-6″~~	~~5′-4″~~	~~5′-8″~~	~~5′-5″~~	~~5′-3″~~	~~4′-11″~~	~~4′-7″~~
~~2-550S162-33~~	~~3′-11″~~	~~3′-4″~~	~~2′-10″~~	~~2′-4″~~	-	~~2′-7″~~	-	-	-	-
~~2-550S162-43~~	~~5′-4″~~	~~4′-10″~~	~~4′-4″~~	~~3′-10″~~	~~3′-5″~~	~~4′-2″~~	~~3′-7″~~	~~3′-1″~~	~~2′-7″~~	~~2′-1″~~
~~2-550S162-54~~	~~6′-11″~~	~~6′-3″~~	~~5′-9″~~	~~5′-3″~~	~~4′-9″~~	~~5′-6″~~	~~4′-11″~~	~~4′-5″~~	~~3′-11″~~	~~3′-5″~~
~~2-550S162-68~~	~~8′-0″~~	~~7′-6″~~	~~6′-11″~~	~~6′-5″~~	~~5′-11″~~	~~6′-9″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~4′-7″~~
~~2-550S162-97~~	~~8′-11″~~	~~8′-6″~~	~~8′-2″~~	~~7′-11″~~	~~7′-8″~~	~~8′-1″~~	~~7′-9″~~	~~7′-6″~~	~~7′-1″~~	~~6′-7″~~
~~2-800S162-33~~	~~2′-8″~~	~~2′-4″~~	~~2′-1″~~	~~1′-11″~~	~~1′-9″~~	~~2′-0″~~	~~1′-9″~~	-	-	-
~~2-800S162-43~~	~~5′-10″~~	~~5′-2″~~	~~4′-7″~~	~~4′-2″~~	~~3′-10″~~	~~4′-5″~~	~~3′-11″~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~
~~2-800S162-54~~	~~8′-0″~~	~~7′-3″~~	~~6′-8″~~	~~6′-1″~~	~~5′-7″~~	~~6′-5″~~	~~5′-9″~~	~~5′-1″~~	~~4′-7″~~	~~4′-0″~~
~~2-800S162-68~~	~~9′-9″~~	~~9′-0″~~	~~8′-3″~~	~~7′-8″~~	~~7′-1″~~	~~8′-0″~~	~~7′-3″~~	~~6′-7″~~	~~6′-0″~~	~~5′-6″~~
~~2-800S162-97~~	~~12′-1″~~	~~11′-7″~~	~~11′-2″~~	~~10′-8″~~	~~10′-2″~~	~~11′-0″~~	~~10′-4″~~	~~9′-9″~~	~~9′-2″~~	~~8′-7″~~
~~2-1000S162-43~~	~~4′-8″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~3′-0″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-6″~~	~~2′-3″~~
~~2-1000S162-54~~	~~9′-1″~~	~~8′-2″~~	~~7′-3″~~	~~6′-7″~~	~~6′-0″~~	~~7′-0″~~	~~6′-2″~~	~~5′-6″~~	~~5′-0″~~	~~4′-6″~~
~~2-1000S162-68~~	~~11′-1″~~	~~10′-2″~~	~~9′-5″~~	~~8′-8″~~	~~8′-1″~~	~~9′-1″~~	~~8′-3″~~	~~7′-6″~~	~~6′-10″~~	~~6′-3″~~
~~2-1000S162-97~~	~~13′-9″~~	~~12′-11″~~	~~12′-2″~~	~~11′-7″~~	~~11′-1″~~	~~11′-11″~~	~~11′-3″~~	~~10′-7″~~	~~9′-11″~~	~~9′-4″~~
~~2-1200S162-54~~	~~7′-8″~~	~~6′-9″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~5′-10″~~	~~5′-1″~~	~~4′-7″~~	~~4′-1″~~	~~3′-9″~~
~~2-1200S162-68~~	~~12′-3″~~	~~11′-3″~~	~~10′-4″~~	~~9′-7″~~	~~8′-11″~~	~~10′-1″~~	~~9′-1″~~	~~8′-3″~~	~~7′-6″~~	~~6′-10″~~
~~2-1200S162-97~~	~~15′-4″~~	~~14′-5″~~	~~13′-7″~~	~~12′-11″~~	~~12′-4″~~	~~13′-4″~~	~~12′-6″~~	~~11′-10″~~	~~11′-1″~~	~~10′-5″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Attic dead load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(5)~~
~~BOX-BEAM HEADER SPANS~~
~~Headers Supporting One Floor, Roof and Ceiling 33 ksi steel[a, b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	2′-2″	-	-	-	-	2′-1″	-	-	-	-
2-350S162-54	2′-11″	2′-5″	-	-	-	2′-10″	2′-4″	-	-	-
2-350S162-68	3′-8″	3′-2″	2′-9″	2′-4″	-	3′-7″	3′-1″	2′-8″	2′-3″	-
2-350S162-97	4′-11″	4′-5″	4′-2″	3′-8″	3′-5″	4′-10″	4′-5″	4′-0″	3′-8″	3′-4″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	3′-5″	2′-9″	2′-1″	-	-	3′-3″	2′-7″	-	-	-
2-550S162-54	4′-4″	3′-9″	3′-2″	2′-7″	2′-1″	4′-3″	3′-7″	3′-1″	2′-6″	-
2-550S162-68	5′-3″	4′-8″	4′-1″	3′-7″	3′-2″	5′-2″	4′-7″	4′-0″	3′-6″	3′-1″
2-550S162-97	7′-0″	6′-5″	5′-10″	5′-5″	5′-0″	6′-11″	6′-4″	5′-9″	5′-4″	4′-11″
2-800S162-33	2′-1″	-	-	-	-	-	-	-	-	-
2-800S162-43	4′-2″	3′-4″	2′-7″	-	-	4′-0″	3′-3″	2′-5″	-	-
2-800S162-54	5′-6″	4′-9″	4′-1″	3′-5″	2′-9″	5′-5″	4′-8″	3′-11″	3′-3″	2′-8″
2-800S162-68	6′-11″	6′-2″	5′-5″	4′-10″	4′-3″	6′-9″	6′-0″	5′-4″	4′-8″	4′-1″
2-800S162-97	9′-4″	8′-6″	7′-10″	7′-3″	6′-8″	9′-2″	8′-4″	7′-8″	7′-1″	6′-7″
2-1000S162-43	4′-4″	3′-9″	2′-11″	-	-	4′-3″	3′-8″	2′-9″	-	-
2-1000S162-54	6′-3″	5′-5″	4′-7″	3′-11″	3′-2″	6′-1″	5′-3″	4′-6″	3′-9″	3′-0″
2-1000S162-68	7′-11″	7′-0″	6′-3″	5′-6″	4′-10″	7′-9″	6′-10″	6′-1″	5′-4″	4′-9″
2-1000S162-97	11′-0″	10′-1″	9′-3″	8′-7″	8′-0″	10′-11″	9′-11″	9′-2″	8′-5″	7′-10″
2-1200S162-54	6′-11″	5′-11″	5′-1″	4′-3″	3′-5″	6′-9″	5′-9″	4′-11″	4′-1″	3′-3″
2-1200S162-68	8′-9″	7′-9″	6′-11″	6′-1″	5′-4″	8′-7″	7′-7″	6′-9″	5′-11″	5′-3″
2-1200S162-97	12′-4″	11′-5″	10′-6″	9′-8″	9′-0″	12′-3″	11′-3″	10′-4″	9′-6″	8′-10″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~
~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 30 psf.~~
~~Attic dead load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(3)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)						GROUND SNOW LOAD (30 psf)			
	Building width[c] (feet)						Building width[c] (feet)			
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-

2-350S162-43	2′-2″	-	-	-	-	2′-1″	-	-	-	-
2-350S162-54	4′-4″	3′-10″	3′-5″	3′-1″	2′-9″	4′-3″	2′-9″	3′-4″	3′-0″	2′-8″
2-350S162-68	5′-0″	4′-9″	4′-7″	4′-2″	3′-9″	4′-11″	4′-8″	4′-6″	4′-1″	3′-9″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	3′-5″	2′-9″	2′-1″	-	-	3′-3″	2′-7″	-	-	-
2-550S162-54	6′-6″	5′-10″	5′-3″	4′-9″	4′-4″	6′-4″	5′-9″	5′-2″	4′-8″	4′-3″
2-550S162-68	7′-2″	6′-10″	6′-5″	5′-11″	5′-6″	7′-0″	6′-9″	6′-4″	5′-10″	5′-4″
2-800S162-33	2′-1″	-	-	-	-	-	-	-	-	-
2-800S162-43	4′-2″	3′-4″	2′-7″	-	-	4′-0″	3′-3″	2′-5″	-	-
2-800S162-54	7′-6″	6′-9″	6′-2″	5′-7″	5′-0″	7′-5″	6′-8″	6′-0″	5′-5″	4′-11″
2-800S162-68	9′-3″	8′-5″	7′-8″	7′-1″	6′-6″	9′-1″	8′-3″	7′-7″	7′-0″	6′-5″
2-1000S162-43	4′-4″	3′-9″	2′-11″	-	-	4′-3″	3′-8″	2′-9″	-	-
2-1000S162-54	8′-6″	7′-6″	6′-8″	6′-0″	5′-5″	8′-4″	7′-4″	6′-6″	5′-10″	5′-4″
2-1000S162-68	10′-6″	9′-7″	8′-9″	8′-0″	7′-5″	10′-4″	9′-5″	8′-7″	7′-11″	7′-3″
2-1200S162-54	7′-1″	6′-2″	5′-6″	5′-0″	4′-6″	6′-11″	6′-1″	5′-5″	4′-10″	4′-5″
2-1200S162-68	11′-7″	10′-7″	9′-8″	8′-11″	8′-2″	11′-5″	10′-5″	9′-6″	8′-9″	8′-0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Second floor dead load is 10 psf.
Roof/Ceiling dead load is 12 psf.
Second floor live load is 30 psf.
Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(6)~~

~~BOX-BEAM HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)[a, b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~						~~GROUND SNOW LOAD (30 psf)~~			
	~~Building width[c] (feet)~~						~~Building width[c] (feet)~~			
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~2′-4″~~	-	-	-	-	~~2′-3″~~	-	-	-	-
~~2-350S162-43~~	~~3′-4″~~	~~2′-11″~~	~~2′-6″~~	~~2′-1″~~	-	~~3′-3″~~	~~2′-10″~~	~~2′-5″~~	~~2′-0″~~	-
~~2-350S162-54~~	~~4′-4″~~	~~3′-10″~~	~~3′-5″~~	~~3′-1″~~	~~2′-9″~~	~~4′-3″~~	~~2′-9″~~	~~3′-4″~~	~~3′-0″~~	~~2′-8″~~
~~2-350S162-68~~	~~5′-0″~~	~~4′-9″~~	~~4′-7″~~	~~4′-2″~~	~~3′-9″~~	~~4′-11″~~	~~4′-8″~~	~~4′-6″~~	~~4′-1″~~	~~3′-9″~~
~~2-350S162-97~~	~~5′-6″~~	~~5′-3″~~	~~5′-1″~~	~~4′-11″~~	~~2′-9″~~	~~5′-5″~~	~~5′-2″~~	~~5′-0″~~	~~4′-10″~~	~~4′-8″~~
~~2-550S162-33~~	~~3′-6″~~	~~2′-11″~~	~~2′-4″~~	-	-	~~3′-5″~~	~~2′-10″~~	~~2′-3″~~	-	-
~~2-550S162-43~~	~~5′-0″~~	~~4′-5″~~	~~3′-11″~~	~~3′-5″~~	~~3′-0″~~	~~4′-11″~~	~~4′-4″~~	~~3′-10″~~	~~3′-4″~~	~~2′-11″~~
~~2-550S162-54~~	~~6′-6″~~	~~5′-10″~~	~~5′-3″~~	~~4′-9″~~	~~4′-4″~~	~~6′-4″~~	~~5′-9″~~	~~5′-2″~~	~~4′-8″~~	~~4′-3″~~
~~2-550S162-68~~	~~7′-2″~~	~~6′-10″~~	~~6′-5″~~	~~5′-11″~~	~~5′-6″~~	~~7′-0″~~	~~6′-9″~~	~~6′-4″~~	~~5′-10″~~	~~5′-4″~~
~~2-550S162-97~~	~~7′-11″~~	~~7′-7″~~	~~7′-3″~~	~~7′-0″~~	~~6′-10″~~	~~7′-9″~~	~~7′-5″~~	~~7′-2″~~	~~6′-11″~~	~~6′-9″~~
~~2-800S162-33~~	~~2′-5″~~	~~2′-2″~~	~~1′-11″~~	~~1′-9″~~	-	~~2′-5″~~	~~2′-1″~~	~~1′-10″~~	~~1′-8″~~	-
~~2-800S162-43~~	~~5′-5″~~	~~4′-9″~~	~~4′-3″~~	~~3′-9″~~	~~3′-5″~~	~~5′-3″~~	~~4′-8″~~	~~4′-1″~~	~~3′-9″~~	~~3′-5″~~
~~2-800S162-54~~	~~7′-6″~~	~~6′-9″~~	~~6′-2″~~	~~5′-7″~~	~~5′-0″~~	~~7′-5″~~	~~6′-8″~~	~~6′-0″~~	~~5′-5″~~	~~4′-11″~~
~~2-800S162-68~~	~~9′-3″~~	~~8′-5″~~	~~7′-8″~~	~~7′-1″~~	~~6′-6″~~	~~9′-1″~~	~~8′-3″~~	~~7′-7″~~	~~7′-0″~~	~~6′-5″~~
~~2-800S162-97~~	~~10′-9″~~	~~10′-3″~~	~~9′-11″~~	~~9′-7″~~	~~9′-3″~~	~~10′-7″~~	~~10′-1″~~	~~9′-9″~~	~~9′-5″~~	~~9′-1″~~
~~2-1000S162-43~~	~~4′-4″~~	~~3′-9″~~	~~3′-4″~~	~~3′-0″~~	~~2′-9″~~	~~4′-3″~~	~~3′-8″~~	~~3′-3″~~	~~2′-11″~~	~~2′-8″~~
~~2-1000S162-54~~	~~8′-6″~~	~~7′-6″~~	~~6′-8″~~	~~6′-0″~~	~~5′-5″~~	~~8′-4″~~	~~7′-4″~~	~~6′-6″~~	~~5′-10″~~	~~5′-4″~~
~~2-1000S162-68~~	~~10′-6″~~	~~9′-7″~~	~~8′-9″~~	~~8′-0″~~	~~7′-5″~~	~~10′-4″~~	~~9′-5″~~	~~8′-7″~~	~~7′-11″~~	~~7′-3″~~

2-1000S162-97	12′-11″	12′-4″	11′-8″	11′-1″	10′-6″	12′-9″	12′-2″	11′-6″	10′-11″	10′-5″
2-1200S162-54	7′-1″	6′-2″	5′-6″	5′-0″	4′-6″	6′-11″	6′-1″	5′-5″	4′-10″	4′-5″
2-1200S162-68	11′-7″	10′-7″	9′-8″	8′-11″	8′-2″	11′-5″	10′-5″	9′-6″	8′-9″	8′-0″
2-1200S162-97	14′-9″	13′-9″	13′-0″	12′-4″	11′-9″	14′-7″	13′-8″	12′-10″	12′-3″	11′-8″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second Floor live loads 30 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(7)~~
~~BOX-BEAM HEADER SPANS~~
~~Headers Supporting One Floor, Roof and Ceiling~~ [a, b]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	-	-	-	-	-	-	-	-	-	-
2-350S162-68	2′-8″	2′-3″	-	-	-	-	-	-	-	-
2-350S162-97	4′-0″	3′-7″	3′-3″	2′-11″	2′-7″	3′-4″	2′-11″	2′-6″	2′-2″	-
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	2′-0″	-	-	-	-	-	-	-	-	-
2-550S162-54	3′-1″	2′-6″	-	-	-	-	-	-	-	-
2-550S162-68	4′-1″	3′-6″	2′-11″	2′-5″	-	3′-1″	2′-5″	-	-	-
2-550S162-97	5′-10″	5′-3″	4′-10″	4′-5″	4′-0″	4′-11″	4′-5″	3′-11″	3′-6″	3′-2″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	2′-6″	-	-	-	-	-	-	-	-	-
2-800S162-54	4′-0″	3′-3″	2′-6″	-	-	2′-8″	-	-	-	-
2-800S162-68	5′-5″	4′-8″	4′-0″	3′-4″	2′-8″	4′-2″	3′-4″	2′-6″	-	-
2-800S162-97	7′-9″	7′-1″	6′-6″	5′-11″	5′-5″	6′-7″	5′-11″	5′-4″	4′-10″	4′-4″
2-1000S162-43	2′-10″	-	-	-	-	-	-	-	-	-
2-1000S162-54	4′-7″	3′-8″	2′-9″	-	-	3′-0″	-	-	-	-
2-1000S162-68	6′-2″	5′-4″	4′-7″	3′-10″	3′-1″	4′-9″	3′-10″	2′-11″	-	-
2-1000S162-97	9′-3″	8′-5″	7′-8″	7′-1″	6′-6″	7′-10″	7′-1″	6′-5″	5′-9″	5′-2″
2-1200S162-54	5′-0″	4′-0″	3′-1″	-	-	3′-4″	-	-	-	-
2-1200S162-68	6′-10″	5′-11″	5′-0″	4′-3″	3′-5″	5′-3″	4′-3″	3′-2″	-	-
2-1200S162-97	10′-5″	9′-6″	8′-8″	8′-0″	7′-4″	8′-10″	8′-0″	7′-3″	6′-6″	5′-10″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 30 psf.~~
~~Attic dead load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(4)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling [a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	3′-5″	3′-0″	2′-7″	2′-2″	-	2′-8″	2′-2″	-	-	-
2-350S162-68	4′-6″	4′-1″	3′-8″	3′-3″	2′-11″	3′-9″	3′-3″	2′-10″	2′-5″	2′-1″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	2′-0″	-	-	-	-	-	-	-	-	-
2-550S162-54	5′-3″	3′-8″	4′-1″	3′-8″	3′-2″	4′-3″	3′-8″	3′-1″	2′-7″	2′-0″
2-550S162-68	6′-5″	5′-10″	5′-3″	4′-9″	4′-4″	5′-5″	4′-9″	4′-3″	3′-9″	3′-4″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	2′-6″	-	-	-	-	-	-	-	-	-
2-800S162-54	6′-1″	5′-5″	4′-10″	4′-3″	3′-9″	4′-11″	4′-3″	3′-8″	3′-0″	2′-5″
2-800S162-68	7′-8″	6′-11″	6′-3″	5′-9″	5′-2″	6′-5″	5′-9″	5′-1″	4′-6″	4′-0″
2-1000S162-43	2′-10″	-	-	-	-	-	-	-	-	-
2-1000S162-54	6′-7″	5′-10″	5′-3″	4′-9″	4′-3″	5′-4″	4′-9″	4′-1″	3′-5″	2′-9″
2-1000S162-68	8′-8″	7′-10″	7′-2″	6′-6″	5′-11″	7′-4″	6′-6″	5′-9″	5′-1″	4′-6″
2-1200S162-54	5′-6″	4′-10″	4′-4″	3′-11^{2}	3′-7″	4′-5″	3′-11″	3′-6″	3′-2″	2′-11″
2-1200S162-68	9′-7″	8′-8″	7′-11″	7′-2″	6′-6″	8′-1″	7′-2″	6′-4″	5′-8″	5′-0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
   Second floor dead load is 10 psf.
   Roof/Ceiling dead load is 12 psf.
   Second floor live load is 30 psf.
   Attic dead load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(8)~~
~~BOX-BEAM HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)~~ [a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~2′-8″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~3′-5″~~	~~3′-0″~~	~~2′-7″~~	~~2′-2″~~	~~-~~	~~2′-8″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~
~~2-350S162-68~~	~~4′-6″~~	~~4′-1″~~	~~3′-8″~~	~~3′-3″~~	~~2′-11″~~	~~3′-9″~~	~~3′-3″~~	~~2′-10″~~	~~2′-5″~~	~~2′-1″~~
~~2-350S162-97~~	~~5′-1″~~	~~4′-10″~~	~~4′-8″~~	~~4′-6″~~	~~4′-5″~~	~~4′-10″~~	~~4′-7″~~	~~4′-4″~~	~~4′-0″~~	~~3′-8″~~
~~2-550S162-33~~	~~2′-4″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~3′-10″~~	~~3′-4″~~	~~2′-9″~~	~~2′-3″~~	~~-~~	~~2′-11″~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~
~~2-550S162-54~~	~~5′-3″~~	~~3′-8″~~	~~4′-1″~~	~~3′-8″~~	~~3′-2″~~	~~4′-3″~~	~~3′-8″~~	~~3′-1″~~	~~2′-7″~~	~~2′-0″~~
~~2-550S162-68~~	~~6′-5″~~	~~5′-10″~~	~~5′-3″~~	~~4′-9″~~	~~4′-4″~~	~~5′-5″~~	~~4′-9″~~	~~4′-3″~~	~~3′-9″~~	~~3′-4″~~

~~2-550S162-97~~	~~7′-4″~~	~~7′-0″~~	~~6′-9″~~	~~6′-6″~~	~~6′-4″~~	~~6′-11″~~	~~6′-8″~~	~~6′-3″~~	~~5′-10″~~	~~5′-5″~~
~~2-800S162-33~~	~~1′-11″~~	~~1′-8″~~	-	-	-	-	-	-	-	-
~~2-800S162-43~~	~~4′-2″~~	~~3′-8″~~	~~3′-4″~~	~~2′-9″~~	~~2′-2″~~	~~3′-5″~~	~~2′-9″~~	-	-	-
~~2-800S162-54~~	~~6′-1″~~	~~5′-5″~~	~~4′-10″~~	~~4′-3″~~	~~3′-9″~~	~~4′-11″~~	~~4′-3″~~	~~3′-8″~~	~~3′-0″~~	~~2′-5″~~
~~2-800S162-68~~	~~7′-8″~~	~~6′-11″~~	~~6′-3″~~	~~5′-9″~~	~~5′-2″~~	~~6′-5″~~	~~5′-9″~~	~~5′-1″~~	~~4′-6″~~	~~4′-0″~~
~~2-800S162-97~~	~~9′-11″~~	~~9′-6″~~	~~9′-2″~~	~~8′-10″~~	~~8′-3″~~	~~9′-5″~~	~~8′-10″~~	~~8′-2″~~	~~7′-7″~~	~~7′-0″~~
~~2-1000S162-43~~	~~3′-4″~~	~~2′-11″~~	~~2′-7″~~	~~2′-5″~~	~~2′-2″~~	~~2′-8″~~	~~2′-5″~~	~~2′-2″~~	-	-
~~2-1000S162-54~~	~~6′-7″~~	~~5′-10″~~	~~5′-3″~~	~~4′-9″~~	~~4′-3″~~	~~5′-4″~~	~~4′-9″~~	~~4′-1″~~	~~3′-5″~~	~~2′-9″~~
~~2-1000S162-68~~	~~8′-8″~~	~~7′-10″~~	~~7′-2″~~	~~6′-6″~~	~~5′-11″~~	~~7′-4″~~	~~6′-6″~~	~~5′-9″~~	~~5′-1″~~	~~4′-6″~~
~~2-1000S162-97~~	~~11′-7″~~	~~10′-11″~~	~~10′-3″~~	~~9′-7″~~	~~9′-0″~~	~~10′-5″~~	~~9′-7″~~	~~8′-10″~~	~~8′-2″~~	~~7′-8″~~
~~2-1200S162-54~~	~~5′-6″~~	~~4′-10″~~	~~4′-4″~~	~~3′-11^{2}~~	~~3′-7″~~	~~4′-5″~~	~~3′-11″~~	~~3′-6″~~	~~3′-2″~~	~~2′-11″~~
~~2-1200S162-68~~	~~9′-7″~~	~~8′-8″~~	~~7′-11″~~	~~7′-2″~~	~~6′-6″~~	~~8′-1″~~	~~7′-2″~~	~~6′-4″~~	~~5′-8″~~	~~5′-0″~~
~~2-1200S162-97~~	~~12′-11″~~	~~12′-2″~~	~~11′-6″~~	~~10′-8″~~	~~10′-0″~~	~~11′-8″~~	~~10′-9″~~	~~9′-11″~~	~~9′-2″~~	~~8′-6″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(9)~~
~~BOX-BEAM HEADER SPANS~~
~~Headers Supporting Two Floors, Roof and Ceiling 33 ksi steel~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-68~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-97~~	~~3′-1″~~	~~2′-8″~~	~~2′-3″~~	-	-	~~3′-1″~~	~~2′-7″~~	~~2′-2″~~	-	-
~~2-550S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-68~~	~~2′-9″~~	-	-	-	-	~~2′-8″~~	-	-	-	-
~~2-550S162-97~~	~~4′-8″~~	~~4′-1″~~	~~3′-7″~~	~~3′-2″~~	~~2′-9″~~	~~4′-7″~~	~~4′-0″~~	~~3′-6″~~	~~3′-1″~~	~~2′-8″~~
~~2-800S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-54~~	~~2′-1″~~	-	-	-	-	-	-	-	-	-
~~2-800S162-68~~	~~3′-8″~~	~~2′-9″~~	-	-	-	~~3′-7″~~	~~2′-8″~~	-	-	-
~~2-800S162-97~~	~~6′-3″~~	~~5′-6″~~	~~4′-11″~~	~~4′-4″~~	~~3′-9″~~	~~6′-2″~~	~~5′-5″~~	~~4′-10″~~	~~4′-3″~~	~~3′-9″~~
~~2-1000S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-1000S162-54~~	~~2′-5″~~	-	-	-	-	~~2′-3″~~	-	-	-	-
~~2-1000S162-68~~	~~4′-3″~~	~~3′-2″~~	~~2′-0″~~	-	-	~~4′-2″~~	~~3′-1″~~	-	-	-
~~2-1000S162-97~~	~~7′-5″~~	~~6′-7″~~	~~5′-10″~~	~~5′-2″~~	~~4′-7″~~	~~7′-4″~~	~~6′-6″~~	~~5′-9″~~	~~5′-1″~~	~~4′-6″~~
~~2-1200S162-54~~	~~2′-7″~~	-	-	-	-	~~2′-6″~~	-	-	-	-

~~2-1200S162-68~~	~~4′-8″~~	~~3′-6″~~	~~2′-2″~~	~~-~~	~~-~~	~~4′-7″~~	~~3′-5″~~	~~2′-0″~~	~~-~~	~~-~~
~~2-1200S162-97~~	~~8′-5″~~	~~7′-5″~~	~~6′-7″~~	~~5′-10″~~	~~5′-2″~~	~~8′-3″~~	~~7′-4″~~	~~6′-6″~~	~~5′-9″~~	~~5′-1″~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Second floor dead load is 10 psf.

Roof/Ceiling dead load is 12 psf.

Second floor live load is 40 psf

Third floor live load is 30 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(5)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	2′-5″	-	-	-	-	2′-4″	-	-	-	-
2-350S162-68	3′-6″	3′-0″	2′-6″	2′-1″	-	3′-5″	2′-11″	2′-6″	2′-0″	-
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	-	-	-	-	-	-	-	-	-	-
2-550S162-54	3′-11″	3′-3″	2′-8″	2′-0″	-	3′-10″	3′-3″	2′-7″	-	-
2-550S162-68	5′-1″	4′-5″	3′-10″	3′-3″	2′-9″	5′-0″	4′-4″	3′-9″	3′-3″	2′-9″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	-	-	-	-	-	-	-	-	-	-
2-800S162-54	4′-7″	3′-10″	3′-1″	2′-5″	-	4′-6″	3′-9″	3′-0″	2′-4″	-
2-800S162-68	6′-0″	5′-3″	4′-7″	3′-11″	3′-4″	6′-0″	5′-2″	4′-6″	3′-11″	3′-3″
2-1000S162-43	-	-	-	-	-	-	-	-	-	-
2-1000S162-54	5′-0″	4′-4″	3′-6″	2′-9″	-	4′-11″	4′-3″	3′-5″	2′-7″	-
2-1000S162-68	6′-10″	6′-0″	5′-3″	4′-6″	3′-10″	6′-9″	5′-11″	5′-2″	4′-5″	3′-9″
2-1200S162-54	4′-2″	3′-7″	3′-3″	2′-11″	-	4′-1″	3′-7″	3′-2″	2′-10″	-
2-1200S162-68	7′-7″	6′-7″	5′-9″	5′-0″	4′-2″	7′-6″	6′-6″	5′-8″	4′-10″	4′-1″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:

Second floor dead load is 10 psf.

Roof/Ceiling dead load is 12 psf.

Second floor live load is 40 psf

Third floor live load is 30 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(10)~~
~~BOX-BEAM HEADER SPANS Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~	~~GROUND SNOW LOAD (30 psf)~~

	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~2′-5″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~2′-4″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-68~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~	~~2′-1″~~	~~-~~	~~3′-5″~~	~~2′-11″~~	~~2′-6″~~	~~2′-0″~~	~~-~~
~~2-350S162-97~~	~~4′-9″~~	~~4′-6″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~4′-8″~~	~~4′-5″~~	~~4′-0″~~	~~3′-8″~~	~~3′-4″~~
~~2-550S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~2′-7″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~2′-6″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-54~~	~~3′-11″~~	~~3′-3″~~	~~2′-8″~~	~~2′-0″~~	~~-~~	~~3′-10″~~	~~3′-3″~~	~~2′-7″~~	~~-~~	~~-~~
~~2-550S162-68~~	~~5′-1″~~	~~4′-5″~~	~~3′-10″~~	~~3′-3″~~	~~2′-9″~~	~~5′-0″~~	~~4′-4″~~	~~3′-9″~~	~~3′-3″~~	~~2′-9″~~
~~2-550S162-97~~	~~6′-10″~~	~~6′-5″~~	~~5′-10″~~	~~5′-5″~~	~~4′-11″~~	~~6′-9″~~	~~6′-4″~~	~~5′-10″~~	~~5′-4″~~	~~4′-11″~~
~~2-800S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-43~~	~~3′-1″~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~	~~3′-0″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~
~~2-800S162-54~~	~~4′-7″~~	~~3′-10″~~	~~3′-1″~~	~~2′-5″~~	~~-~~	~~4′-6″~~	~~3′-9″~~	~~3′-0″~~	~~2′-4″~~	~~-~~
~~2-800S162-68~~	~~6′-0″~~	~~5′-3″~~	~~4′-7″~~	~~3′-11″~~	~~3′-4″~~	~~6′-0″~~	~~5′-2″~~	~~4′-6″~~	~~3′-11″~~	~~3′-3″~~
~~2-800S162-97~~	~~9′-2″~~	~~8′-4″~~	~~7′-8″~~	~~7′-0″~~	~~6′-6″~~	~~9′-1″~~	~~8′-3″~~	~~7′-7″~~	~~7′-0″~~	~~6′-5″~~
~~2-1000S162-43~~	~~2′-6″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~2′-6″~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~
~~2-1000S162-54~~	~~5′-0″~~	~~4′-4″~~	~~3′-6″~~	~~2′-9″~~	~~-~~	~~4′-11″~~	~~4′-3″~~	~~3′-5″~~	~~2′-7″~~	~~-~~
~~2-1000S162-68~~	~~6′-10″~~	~~6′-0″~~	~~5′-3″~~	~~4′-6″~~	~~3′-10″~~	~~6′-9″~~	~~5′-11″~~	~~5′-2″~~	~~4′-5″~~	~~3′-9″~~
~~2-1000S162-97~~	~~10′-0″~~	~~9′-1″~~	~~8′-3″~~	~~7′-8″~~	~~7′-0″~~	~~9′-10″~~	~~9′-0″~~	~~8′-3″~~	~~7′-7″~~	~~7′-0″~~
~~2-1200S162-54~~	~~4′-2″~~	~~3′-7″~~	~~3′-3″~~	~~2′-11″~~	~~-~~	~~4′-1″~~	~~3′-7″~~	~~3′-2″~~	~~2′-10″~~	~~-~~
~~2-1200S162-68~~	~~7′-7″~~	~~6′-7″~~	~~5′-9″~~	~~5′-0″~~	~~4′-2″~~	~~7′-6″~~	~~6′-6″~~	~~5′-8″~~	~~4′-10″~~	~~4′-1″~~
~~2-1200S162-97~~	~~11′-2″~~	~~10′-1″~~	~~9′-3″~~	~~8′-6″~~	~~7′-10″~~	~~11′-0″~~	~~10′-0″~~	~~9′-2″~~	~~9′-2″~~	~~7′-9″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf.~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(11)~~
~~BOX-BEAM HEADER SPANS~~
~~Headers Supporting Two Floors, Roof and Ceiling 33 ksi steel~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-68~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-97~~	~~2′-11″~~	~~2′-5″~~	~~2′-0″~~	-	-	~~2′-7″~~	~~2′-2″~~	-	-	-
~~2-550S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-68~~	~~2′-5″~~	-	-	-	-	-	-	-	-	-
~~2-550S162-97~~	~~4′-4″~~	~~3′-10″~~	~~3′-4″~~	~~2′-10″~~	~~2′-5″~~	~~4′-0″~~	~~3′-6″~~	~~3′-1″~~	~~2′-7″~~	~~2′-2″~~
~~2-800S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-68~~	~~3′-3″~~	~~2′-3″~~	-	-	-	~~2′-8″~~	-	-	-	-
~~2-800S162-97~~	~~5′-11″~~	~~5′-2″~~	~~4′-6″~~	~~4′-0″~~	~~3′-5″~~	~~5′-6″~~	~~4′-10″~~	~~4′-3″~~	~~3′-8″~~	~~3′-2″~~
~~2-1000S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-1000S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-1000S162-68~~	~~3′-9″~~	~~2′-7″~~	-	-	-	~~3′-1″~~	-	-	-	-
~~2-1000S162-97~~	~~7′-0″~~	~~6′-2″~~	~~5′-5″~~	~~4′-9″~~	~~4′-2″~~	~~6′-6″~~	~~5′-9″~~	~~5′-1″~~	~~4′-5″~~	~~3′-10″~~
~~2-1200S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-1200S162-68~~	~~4′-2″~~	~~2′-10″~~	-	-	-	~~3′-5″~~	~~2′-0″~~	-	-	-
~~2-1200S162-97~~	~~7′-11″~~	~~7′-0″~~	~~6′-2″~~	~~5′-5″~~	~~4′-8″~~	~~7′-4″~~	~~6′-6″~~	~~5′-9″~~	~~5′-0″~~	~~4′-4″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~

~~Roof/Ceiling dead load is 12 psf.~~

~~Second floor live load is 40 psf~~

~~Third floor live load is 30 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(6)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling[a, b, d]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	2′-2″	-	-	-	-	-	-	-	-	-
2-350S162-68	3′-3″	2′-9″	2′-3″	-	-	2′-11″	2′-5″	-	-	-

2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	-	-	-	-	-	-	-	-	-	-
2-550S162-54	3′-7″	2′-11″	2′-3″	-	-	3′-3″	2′-7″	-	-	-
2-550S162-68	4′-9″	2′-1″	3′-6″	3′-0″	2′-5″	4′-4″	3′-9″	3′-2″	2′-8″	2′-1″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	-	-	-	-	-	-	-	-	-	-
2-800S162-54	4′-3″	3′-5″	2′-8″	-	-	3′-9″	3′-0″	2′-3″	-	-
2-800S162-68	5′-8″	4′-11″	4′-2″	3′-7″	2′-11″	5′-3″	4′-6″	3′-10″	3′-3″	2′-7″
2-1000S162-43	-	-	-	-	-	-	-	-	-	-
2-1000S162-54	4′-8″	3′-11″	3′-1″	2′-2″	-	4′-3″	3′-5″	2′-7″	-	-
2-1000S162-68	6′-5″	5′-7″	4′-9″	4′-1″	3′-4″	5′-11″	5′-1″	4′-5″	3′-8″	2′-11″
2-1200S162-54	3′-11″	3′-5″	3′-0″	2′-4″	-	3′-7″	3′-2″	2′-10″	-	-
2-1200S162-68	7′-1″	6′-2″	5′-3″	4′-6″	3′-8″	6′-6″	5′-8″	4′-10″	4′-0″	3′-3″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.

b. Design load assumptions:
Second floor dead load is 10 psf.
Roof/Ceiling dead load is 12 psf.
Second floor live load is 40 psf
Third floor live load is 30 psf.
Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R603.6(12)~~
~~BOX-BEAM HEADER SPANS[a,b,c] Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)[a,b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-68~~	~~3′-3″~~	~~2′-9″~~	~~2′-3″~~	~~-~~	~~-~~	~~2′-11″~~	~~2′-5″~~	~~-~~	~~-~~	~~-~~
~~2-350S162-97~~	~~4′-6″~~	~~4′-3″~~	~~3′-10″~~	~~3′-6″~~	~~3′-2″~~	~~4′-3″~~	~~4′-0″~~	~~3′-7″~~	~~3′-3″~~	~~3′-0″~~
~~2-550S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-54~~	~~3′-7″~~	~~2′-11″~~	~~2′-3″~~	~~-~~	~~-~~	~~3′-3″~~	~~2′-7″~~	~~-~~	~~-~~	~~-~~
~~2-550S162-68~~	~~4′-9″~~	~~2′-1″~~	~~3′-6″~~	~~3′-0″~~	~~2′-5″~~	~~4′-4″~~	~~3′-9″~~	~~3′-2″~~	~~2′-8″~~	~~2′-1″~~
~~2-550S162-97~~	~~6′-5″~~	~~6′-1″~~	~~5′-7″~~	~~5′-1″~~	~~4′-8″~~	~~6′-3″~~	~~5′-10″~~	~~5′-4″~~	~~4′-10″~~	~~4′-5″~~
~~2-800S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-43~~	~~2′-8″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-54~~	~~4′-3″~~	~~3′-5″~~	~~2′-8″~~	~~-~~	~~-~~	~~3′-9″~~	~~3′-0″~~	~~2′-3″~~	~~-~~	~~-~~
~~2-800S162-68~~	~~5′-8″~~	~~4′-11″~~	~~4′-2″~~	~~3′-7″~~	~~2′-11″~~	~~5′-3″~~	~~4′-6″~~	~~3′-10″~~	~~3′-3″~~	~~2′-7″~~
~~2-800S162-97~~	~~8′-9″~~	~~8′-0″~~	~~7′-3″~~	~~6′-8″~~	~~6′-2″~~	~~8′-4″~~	~~7′-7″~~	~~6′-11″~~	~~6′-4″~~	~~5′-10″~~
~~2-1000S162-43~~	~~2′-4″~~	~~2′-0″~~	~~-~~	~~-~~	~~-~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-1000S162-54~~	~~4′-8″~~	~~3′-11″~~	~~3′-1″~~	~~2′-2″~~	~~-~~	~~4′-3″~~	~~3′-5″~~	~~2′-7″~~	~~-~~	~~-~~
~~2-1000S162-68~~	~~6′-5″~~	~~5′-7″~~	~~4′-9″~~	~~4′-1″~~	~~3′-4″~~	~~5′-11″~~	~~5′-1″~~	~~4′-5″~~	~~3′-8″~~	~~2′-11″~~
~~2-1000S162-97~~	~~9′-6″~~	~~8′-8″~~	~~7′-11″~~	~~7′-3″~~	~~6′-8″~~	~~9′-0″~~	~~8′-3″~~	~~7′-6″~~	~~6′-11″~~	~~6′-4″~~

2-1200S162-54	3′-11″	3′-5″	3′-0″	2′-4″	-	3′-7″	3′-2″	2′-10″	-	-
2-1200S162-68	7′-1″	6′-2″	5′-3″	4′-6″	3′-8″	6′-6″	5′-8″	4′-10″	4′-0″	3′-3″
2-1200S162-97	10′-8″	9′-8″	8′-10″	8′-1″	7′-5″	10′-1″	9′-2″	8′-5″	7′-9″	7′-1″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(13)~~
~~BACK-TO-BACK HEADER SPANS Headers Supporting Roof and Ceiling Only (33 ksi steel)~~[a,b]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	2′-11″	2′-4″	-	-	-	2′-5″	-	-	-	-
2-350S162-43	4′-8″	3′-10″	3′-5″	3′-1″	2′-9″	3′-11″	3′-5″	3′-0″	2′-8″	2′-4″
2-350S162-54	5′-3″	4′-9″	4′-4″	4′-1″	3′-8″	4′-10″	4′-4″	4′-0″	3′-8″	3′-4″
2-350S162-68	6′-1″	5′-7″	5′-2″	4′-10″	4′-6″	5′-8″	5′-3″	4′-10″	4′-6″	4′-2″
2-350S162-97	7′-3″	6′-10″	6′-5″	6′-0″	5′-8″	6′-11″	6′-5″	6′-0″	5′-8″	5′-4″
2-550S162-33	4′-5″	3′-9″	3′-1″	2′-6″	-	3′-9″	3′-2″	2′-6″	-	-
2-550S162-43	6′-2″	5′-7″	5′-0″	4′-7″	4′-2″	5′-7″	5′-0″	4′-6″	4′-1″	3′-8″
2-550S162-54	7′-5″	6′-9″	6′-3″	5′-9″	5′-4″	6′-10″	6′-3″	5′-9″	5′-4″	4′-11″
2-550S162-68	6′-7″	7′-11″	7′-4″	6′-10″	6′-5″	8′-0″	7′-4″	6′-10″	6′-5″	6′-0″
2-550S162-97	10′-5″	9′-8″	9′-0″	8′-6″	8′-0″	9′-9″	9′-0″	8′-6″	8′-0″	7′-7″
2-800S162-33	4′-5″	3′-11″	3′-5″	3′-1″	2′-4″	3′-11″	3′-6″	3′-0″	2′-3″	-
2-800S162-43	7′-7″	6′-10″	6′-2″	5′-8″	5′-2″	6′-11″	6′-2″	5′-7″	5′-1″	4′-7″
2-800S162-54	9′-3″	8′-7″	7′-11″	7′-4″	6′-10″	8′-8″	7′-11″	7′-4″	6′-9″	6′-3″
2-800S162-68	10′-7″	9′-10″	9′-4″	8′-10″	8′-5″	9′-11″	9′-4″	8′-10″	8′-4″	7′-11″
2-800S162-97	13′-9″	12′-9″	12′-0″	11′-3″	10′-8″	12′-10″	12′-0″	11′-3″	10′-7″	10′-0″
2-1000S162-43	7′-10″	6′-10″	6′-1″	5′-6″	5′-0″	6′-11″	6′-1″	5′-5″	4′-11″	4′-6″
2-1000S162-54	10′-5″	9′-9″	9′-0″	8′-4″	7′-9″	9′-10″	9′-0″	8′-4″	7′-9″	7′-2″
2-1000S162-68	12′-1″	11′-3″	10′-8″	10′-1″	9′-7″	11′-4″	10′-8″	10′-1″	9′-7″	9′-1″
2-1000S162-97	15′-3″	14′-3″	13′-5″	12′-9″	12′-2″	14′-4″	13′-5″	12′-8″	12′-1″	11′-6″
2-1200S162-54	11′-6″	10′-9″	10′-0″	9′-0″	8′-2″	10′-10″	10′-0″	9′-0″	8′-1″	7′-4″
2-1200S162-68	13′-4″	12′-6″	11′-9″	11′-2″	10′-8″	12′-7″	11′-10″	11′-2″	10′-7″	10′-1″
2-1200S162-97	16′-8″	15′-7″	14′-8″	13′-11″	13′-3″	15′-8″	14′-8″	13′-11″	13′-2″	12′-7″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~**TABLE R603.6(14)**~~

~~**BACK-TO-BACK HEADER SPANS Headers Supporting Roof and Ceiling Only (50 ksi steel)[a,b]**~~

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	4′-2″	3′-8″	3′-3″	2′-10″	2′-6″	3′-8″	3′-3″	2′-10″	2′-5″	2′-1″
2-350S162-43	5′-5″	5′-0″	4′-6″	4′-2″	3′-10″	5′-0″	4′-7″	4′-2″	3′-10″	3′-6″
2-350S162-54	6′-2″	5′-10″	5′-8″	5′-4″	5′-0″	5′-11″	5′-8″	5′-4″	5′-0″	4′-8″
2-350S162-68	6′-7″	6′-3″	6′-0″	5′-10″	5′-8″	6′-4″	6′-1″	5′-10″	5′-8″	5′-6″
2-350S162-97	7′-3″	6′-11″	6′-8″	6′-5″	6′-3″	7′-0″	6′-8″	6′-5″	6′-3″	6′-0″
2-550S162-33	5′-10″	5′-3″	4′-8″	4′-3″	3′-9″	5′-3″	4′-9″	4′-2″	3′-9″	3′-3″
2-550S162-43	7′-9″	7′-2″	6′-7″	6′-1″	5′-8″	7′-3″	6′-7″	6′-1″	5′-8″	5′-3″
2-550S162-54	8′-9″	8′-5″	8′-1″	7′-9″	7′-5″	8′-6″	8′-1″	7′-9″	7′-5″	6′-11″
2-550S162-68	9′-5″	9′-0″	8′-8″	8′-4″	8′-1″	9′-1″	8′-8″	8′-4″	8′-1″	7′-10″
2-550S162-97	10′-5″	10′-0″	9′-7″	9′-3″	9′-0″	10′-0″	9′-7″	9′-3″	8′-11″	8′-8″
2-800S162-33	4′-5″	3′-11″	3′-5″	3′-1″	2′-10″	3′-11″	3′-6″	3′-1″	2′-9″	2′-6″
2-800S162-43	9′-1″	8′-5″	7′-8″	6′-11″	6′-3″	8′-6″	7′-8″	6′-10″	6′-2″	5′-8″
2-800S162-54	10′-10″	10′-2″	9′-7″	9′-1″	8′-8″	10′-2″	9′-7″	9′-0″	8′-7″	8′-1″
2-800S162-68	12′-8″	11′-10″	11′-2″	10′-7″	10′-1″	11′-11″	11′-2″	10′-7″	10′-0″	9′-7″
2-800S162-97	14′-2″	13′-6″	13′-0″	12′-7″	12′-2″	13′-8″	13′-1″	12′-7″	12′-2″	11′-9″
2-1000S162-43	7′-10″	6′-10″	6′-1″	5′-6″	5′-0″	6′-11″	6′-1″	5′-5″	4′-11″	4′-6″
2-1000S162-54	12′-3″	11′-5″	10′-9″	10′-3″	9′-9″	11′-6″	10′-9″	10′-2″	9′-8″	8′-11″
2-1000S162-68	14′-5″	13′-5″	12′-8″	12′-0″	11′-6″	13′-6″	12′-8″	12′-0″	11′-5″	10′-11″
2-1000S162-97	17′-1″	16′-4″	15′-8″	14′-11″	14′-3″	16′-5″	15′-9″	14′-10″	14′-1″	13′-6″
2-1200S162-54	12′-11″	11′-3″	10′-0″	9′-0″	8′-2″	11′-5″	10′-0″	9′-0″	8′-1″	7′-4″
2-1200S162-68	15′-11″	14′-10″	14′-0″	13′-4″	12′-8″	15′-0″	14′-0″	13′-3″	12′-7″	12′-0″
2-1200S162-97	19′-11″	18′-7″	17′-6″	16′-8″	15′-10″	18′-9″	17′-7″	16′-7″	15′-9″	15′-0″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Roof/ceiling dead load is 12 psf.~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(15)~~

~~BACK-TO-BACK HEADER SPANS Headers Supporting Roof and Ceiling Only (33 ksi steel)~~[~~a, b~~]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width~~[~~c~~] ~~(feet)~~					~~Building width~~[~~c~~] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-43~~	~~2′-6″~~	-	-	-	-	-	-	-	-	-
~~2-350S162-54~~	~~3′-6″~~	~~3′-1″~~	~~2′-8″~~	~~2′-4″~~	~~2′-0″~~	~~2′-7″~~	~~2′-1″~~	-	-	-
~~2-350S162-68~~	~~4′-4″~~	~~3′-11″~~	~~3′-7″~~	~~3′-3″~~	~~2′-11″~~	~~3′-5″~~	~~3′-0″~~	~~2′-8″~~	~~2′-4″~~	~~2′-1″~~
~~2-350S162-97~~	~~5′-5″~~	~~5′-0″~~	~~4′-8″~~	~~4′-6″~~	~~4′-1″~~	~~4′-6″~~	~~4′-2″~~	~~3′-10″~~	~~3′-6″~~	~~3′-3″~~
~~2-550S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-43~~	~~3′-10″~~	~~3′-3″~~	~~2′-9″~~	~~2′-2″~~	-	~~2′-6″~~	-	-	-	-
~~2-550S162-54~~	~~5′-1″~~	~~4′-7″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~3′-11″~~	~~3′-5″~~	~~2′-11″~~	~~2′-6″~~	~~2′-0″~~
~~2-550S162-68~~	~~6′-2″~~	~~5′-8″~~	~~5′-2″~~	~~4′-9″~~	~~4′-5″~~	~~5′-0″~~	~~4′-6″~~	~~4′-1″~~	~~3′-9″~~	~~3′-4″~~
~~2-550S162-97~~	~~7′-9″~~	~~7′-2″~~	~~6′-8″~~	~~6′-3″~~	~~5′-11″~~	~~6′-6″~~	~~6′-0″~~	~~5′-7″~~	~~5′-2″~~	~~4′-10″~~
~~2-800S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-43~~	~~4′-10″~~	~~4′-1″~~	~~3′-6″~~	~~2′-11″~~	~~2′-3″~~	~~3′-3″~~	~~2′-5″~~	-	-	-
~~2-800S162-54~~	~~6′-6″~~	~~5′-10″~~	~~5′-3″~~	~~4′-9″~~	~~4′-4″~~	~~5′-1″~~	~~4′-6″~~	~~3′-11″~~	~~3′-4″~~	~~2′-10″~~
~~2-800S162-68~~	~~8′-1″~~	~~7′-5″~~	~~6′-10″~~	~~6′-4″~~	~~5′-11″~~	~~6′-8″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~4′-7″~~
~~2-800S162-97~~	~~10′-3″~~	~~9′-7″~~	~~8′-11″~~	~~8′-5″~~	~~7′-11″~~	~~8′-8″~~	~~8′-0″~~	~~7′-6″~~	~~7′-0″~~	~~6′-7″~~
~~2-1000S162-43~~	~~4′-8″~~	~~4′-1″~~	~~3′-8″~~	~~3′-4″~~	~~2′-8″~~	~~3′-6″~~	~~2′-10″~~	-	-	-
~~2-1000S162-54~~	~~7′-5″~~	~~6′-8″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~5′-10″~~	~~5′-1″~~	~~4′-6″~~	~~3′-11″~~	~~3′-4″~~
~~2-1000S162-68~~	~~9′-4″~~	~~8′-7″~~	~~7′-11″~~	~~7′-4″~~	~~6′-10″~~	~~7′-8″~~	~~7′-0″~~	~~6′-4″~~	~~5′-10″~~	~~5′-4″~~
~~2-1000S162-97~~	~~11′-9″~~	~~11′-0″~~	~~10′-5″~~	~~9′-11″~~	~~9′-5″~~	~~10′-3″~~	~~9′-7″~~	~~8′-11″~~	~~8′-4″~~	~~7′-10″~~
~~2-1200S162-54~~	~~7′-8″~~	~~6′-9″~~	~~6′-1″~~	~~5′-6″~~	~~5′-0″~~	~~5′-10″~~	~~5′-1″~~	~~4′-7″~~	~~4′-1″~~	~~3′-9″~~
~~2-1200S162-68~~	~~10′-4″~~	~~9′-6″~~	~~8′-10″~~	~~8′-2″~~	~~7′-7″~~	~~8′-7″~~	~~7′-9″~~	~~7′-1″~~	~~6′-6″~~	~~6′-0″~~
~~2-1200S162-97~~	~~12′-10″~~	~~12′-1″~~	~~11′-5″~~	~~10′-10″~~	~~10′-4″~~	~~11′-2″~~	~~10′-6″~~	~~9′-11″~~	~~9′-5″~~	~~9′-0″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Roof/ceiling dead load is 12 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(16)
BACK-TO-BACK HEADER SPANS Headers Supporting Roof and Ceiling Only (50 ksi steel)[a, b]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	2′-3″	-	-	-	-	-	-	-	-	-
2-350S162-43	3′-8″	3′-3″	2′-10″	2′-6″	2′-2″	2′-8″	2′-3″	-	-	-
2-350S162-54	4′-9″	4′-4″	4′-0″	3′-8″	3′-8″	3′-10″	3′-5″	3′-1″	2′-9″	2′-5″
2-350S162-68	5′-7″	5′-4″	5′-2″	4′-11″	4′-7″	5′-1″	4′-8″	4′-3″	3′-11″	3′-8″
2-350S162-97	6′-2″	5′-11″	5′-8″	5′-6″	5′-4″	5′-8″	5′-5″	5′-3″	5′-0″	4′-11″
2-550S162-33	3′-6″	2′-10″	2′-3″	-	-	2′-0″	-	-	-	-
2-550S162-43	5′-5″	4′-10″	4′-4″	3′-11″	3′-6″	4′-2″	3′-8″	3′-2″	2′-8″	2′-3″
2-550S162-54	7′-2″	6′-6″	6′-0″	5′-7″	5′-2″	5′-10″	5′-3″	4′-10″	4′-5″	4′-0″
2-550S162-68	8′-0″	7′-8″	7′-3″	6′-11″	6′-6″	7′-2″	6′-7″	6′-1″	5′-8″	5′-4″
2-550S162-97	8′-11″	8′-6″	8′-2″	7′-11″	7′-8″	8′-1″	7′-9″	7′-6″	7′-2″	6′-11″
2-800S162-33	2′-8″	2′-4″	2′-1″	1′-11″	-	2′-0″	-	-	-	-
2-800S162-43	5′-10″	5′-2″	4′-7″	4′-2″	3′-10″	4′-5″	3′-11″	3′-6″	3′-2″	2′-9″
2-800S162-54	8′-4″	7′-8″	7′-1″	6′-7″	6′-1″	6′-10″	6′-3″	5′-8″	5′-2″	4′-9″
2-800S162-68	9′-9″	9′-2″	8′-8″	8′-3″	7′-10″	8′-6″	7′-11″	7′-4″	6′-10″	6′-5″
2-800S162-97	12′-1″	11′-7″	11′-2″	10′-8″	10′-2″	11′-0″	10′-4″	9′-9″	9′-3″	8′-10″
2-1000S162-43	4′-8″	4′-1″	2′-8″	3′-4″	3′-0″	3′-6″	10′-1″	2′-9″	2′-6″	2′-3″
2-1000S162-54	9′-3″	8′-2″	7′-3″	6′-7″	6′-0″	7′-0″	6′-2″	5′-6″	5′-0″	4′-6″
2-1000S162-68	11′-1″	10′-5″	9′-10″	9′-4″	8′-11″	9′-8″	9′-1″	8′-5″	7′-10″	7′-4″
2-1000S162-97	13′-9″	12′-11″	12′-2″	11′-7″	11′-1″	11′-11″	11′-3″	10′-7″	10′-1″	9′-7″
2-1200S162-54	7′-8″	6′-9″	6′-1″	5′-6″	5′-0″	5′-10″	5′-1″	4′-7″	4′-1″	3′-9″
2-1200S162-68	12′-3″	11′-6″	10′-11″	10′-4″	9′-11″	10′-8″	10′-0″	9′-2″	8′-4″	7′-7″
2-1200S162-97	15′-4″	14′-5″	13′-7″	12′-11″	12′-4″	13′-4″	12′-6″	11′-10″	11′-3″	10′-9″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
Roof/ceiling dead load is 12 psf.
Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.

~~TABLE R603.6(17)~~

~~BACK-TO-BACK HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~2′-2″~~	~~-~~	~~-~~	~~-~~	~~-~~	~~2′-1″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~3′-3″~~	~~2′-9″~~	~~2′-5″~~	~~2′-0″~~	~~-~~	~~3′-2″~~	~~2′-9″~~	~~2′-4″~~	~~-~~	~~-~~
~~2-350S162-68~~	~~4′-4″~~	~~3′-8″~~	~~3′-3″~~	~~2′-11″~~	~~2′-8″~~	~~4′-0″~~	~~3′-7″~~	~~3′-2″~~	~~2′-11″~~	~~2′-7″~~
~~2-350S162-97~~	~~5′-2″~~	~~4′-9″~~	~~4′-4″~~	~~4′-1″~~	~~3′-9″~~	~~5′-1″~~	~~4′-8″~~	~~4′-4″~~	~~4′-0″~~	~~3′-9″~~
~~2-550S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~3′-6″~~	~~2′-10″~~	~~2′-3″~~	~~-~~	~~-~~	~~3′-5″~~	~~2′-9″~~	~~2′-2″~~	~~-~~	~~-~~
~~2-550S162-54~~	~~4′-9″~~	~~4′-2″~~	~~3′-9″~~	~~3′-3″~~	~~2′-10″~~	~~4′-8″~~	~~4′-1″~~	~~3′-8″~~	~~3′-2″~~	~~2′-9″~~
~~2-550S162-68~~	~~5′-10″~~	~~5′-3″~~	~~4′-10″~~	~~4′-5″~~	~~4′-1″~~	~~5′-9″~~	~~5′-3″~~	~~4′-9″~~	~~4′-4″~~	~~4′-0″~~
~~2-550S162-97~~	~~7′-4″~~	~~6′-9″~~	~~6′-4″~~	~~5′-11″~~	~~5′-6″~~	~~7′-3″~~	~~6′-9″~~	~~6′-3″~~	~~5′-10″~~	~~5′-5″~~
~~2-800S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-43~~	~~4′-4″~~	~~3′-8″~~	~~2′-11″~~	~~2′-3″~~	~~-~~	~~4′-3″~~	~~3′-6″~~	~~2′-10″~~	~~2′-1″~~	~~-~~
~~2-800S162-54~~	~~6′-1″~~	~~5′-5″~~	~~4′-10″~~	~~4′-4″~~	~~3′-10″~~	~~6′-0″~~	~~5′-4″~~	~~4′-9″~~	~~4′-3″~~	~~3′-9″~~
~~2-800S162-68~~	~~7′-8″~~	~~7′-0″~~	~~6′-5″~~	~~5′-11″~~	~~5′-5″~~	~~7′-7″~~	~~6′-11″~~	~~6′-4″~~	~~5′-10″~~	~~5′-4″~~
~~2-800S162-97~~	~~9′-10″~~	~~9′-1″~~	~~8′-5″~~	~~7′-11″~~	~~7′-5″~~	~~9′-8″~~	~~8′-11″~~	~~8′-4″~~	~~7′-10″~~	~~7′-4″~~
~~2-1000S162-43~~	~~4′-4″~~	~~3′-9″~~	~~3′-4″~~	~~2′-8″~~	~~-~~	~~4′-3″~~	~~3′-8″~~	~~3′-3″~~	~~2′-6″~~	~~-~~
~~2-1000S162-54~~	~~6′-11″~~	~~6′-2″~~	~~5′-6″~~	~~5′-0″~~	~~4′-5″~~	~~6′-10″~~	~~6′-1″~~	~~5′-5″~~	~~4′-10″~~	~~4′-4″~~
~~2-1000S162-68~~	~~8′-10″~~	~~8′-1″~~	~~7′-5″~~	~~6′-10″~~	~~6′-4″~~	~~8′-8″~~	~~7′-11″~~	~~7′-3″~~	~~6′-8″~~	~~6′-2″~~
~~2-1000S162-97~~	~~11′-3″~~	~~10′-7″~~	~~9′-11″~~	~~9′-5″~~	~~8′-10″~~	~~11′-2″~~	~~10′-5″~~	~~9′-10″~~	~~9′-3″~~	~~8′-9″~~
~~2-1200S162-54~~	~~7′-1″~~	~~6′-2″~~	~~5′-6″~~	~~5′-0″~~	~~4′-6″~~	~~6′-11″~~	~~6′-1″~~	~~5′-5″~~	~~4′-10″~~	~~4′-5″~~
~~2-1200S162-68~~	~~9′-10″~~	~~9′-0″~~	~~8′-3″~~	~~7′-7″~~	~~7′-0″~~	~~9′-8″~~	~~8′-10″~~	~~8′-1~~[11]	~~7′-6″~~	~~6′-11″~~
~~2-1200S162-97~~	~~12′-4″~~	~~11′-7″~~	~~10′-11″~~	~~10′-4″~~	~~9′-10″~~	~~12′-3″~~	~~11′-5″~~	~~10′-9″~~	~~10′-3″~~	~~9′-9″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~

~~Roof/Ceiling dead load is 12 psf.~~

~~Second floor live load is 30 psf~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

~~TABLE R603.6(18)~~

~~BACK-TO-BACK HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)~~[a, b]

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	3′-4″	2′-11″	2′-6″	2′-2″	-	3′-3″	2′-10″	2′-5″	2′-1″	-
2-350S162-54	4′-6″	4′-1″	3′-8″	3′-4″	3′-0″	4′-5″	4′-0″	3′-7″	3′-3″	2′-11″
2-350S162-68	5′-0″	4′-9″	4′-7″	4′-5″	4′-3″	4′-11″	4′-8″	4′-6″	4′-4″	4′-2″
2-350S162-97	5′-6″	5′-3″	5′-1″	4′-11″	4′-9″	5′-5″	5′-2″	5′-0″	4′-10″	4′-8″
2-550S162-33	3′-1″	2′-5″	-	-	-	3′-0″	2′-3″	-	-	-
2-550S162-43	5′-1″	4′-6″	4′-0″	3′-6″	3′-1″	4′-11″	4′-5″	3′-11″	3′-5″	3′-0″
2-550S162-54	6′-8″	6′-2″	5′-7″	5′-2″	4′-9″	6′-6″	6′-0″	5′-6″	5′-1″	4′-8″
2-550S162-68	7′-2″	6′-10″	6′-7″	6′-4″	6′-1″	7′-0″	6′-9″	6′-6″	6′-3″	6′-0″
2-550S162-97	7′-11″	7′-7″	7′-3″	7′-0″	6′-10″	7′-9″	7′-5″	7′-2″	6′-11″	6′-9″
2-800S162-33	2′-5″	2′-2″	1′-11″	-	-	2′-5″	2′-1″	1′-10″	-	-
2-800S162-43	5′-5″	4′-9″	4′-3″	3′-9″	3′-5″	5′-3″	4′-8″	4′-1″	3′-9″	3′-5″
2-800S162-54	7′-11″	7′-2″	6′-7″	6′-1″	5′-7″	7′-9″	7′-1″	6′-6″	6′-0″	5′-6″
2-800S162-68	9′-5″	8′-9″	8′-3″	7′-9″	7′-4″	9′-3″	8′-8″	8′-2″	7′-8″	7′-3″
2-800S162-97	10′-9″	10′-3″	9′-11″	9′-7″	9′-3″	10′-7″	10′-1″	9′-9″	9′-5″	9′-1″
2-1000S162-43	4′-4″	3′-9″	3′-4″	3′-0″	2′-9″	4′-3″	3′-8″	3′-3″	2′-11″	2′-8″
2-1000S162-54	8′-6″	7′-5″	6′-8″	6′-0″	5′-5″	8′-4″	7′-4″	6′-6″	5′-10″	5′-4″
2-1000S162-68	10′-8″	10′-0″	9′-5″	8′-11″	8′-4″	10′-7″	9′-10″	9′-4″	8′-9″	8′-3″
2-1000S162-97	12′-11″	12′-4″	11′-8″	11′-1″	10′-6″	12′-9″	12′-2″	11′-6″	10′-11″	10′-5″
2-1200S162-54	7′-1″	6′-2″	5′-6″	5′-0″	4′-6″	6′-11″	6′-1″	5′-5″	4′-10″	4′-5″
2-1200S162-68	11′-9″	11′-0″	10′-5″	9′-10″	9′-1″	11′-8″	10′-11″	10′-3″	9′-9″	8′-11″
2-1200S162-97	14′-9″	13′-9″	13′-0″	12′-4″	11′-9″	14′-7″	13′-8″	12′-10″	12′-3″	11′-8″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~

~~Roof/Ceiling dead load is 12 psf.~~

~~Second floor live load is 30 psf~~

~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header.~~

TABLE R603.6(19)
BACK-TO-BACK HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)[a, b]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	2′-4″	-	-	-	-	-	-	-	-	-
2-350S162-68	3′-3″	2′-10″	2′-6″	2′-2″	-	2′-7″	2′-2″	-	-	-
2-350S162-97	4′-4″	4′-0″	3′-8″	3′-4″	3′-1″	3′-9″	3′-4″	3′-1″	2′-9″	2′-6″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	2′-2″	-	-	-	-	-	-	-	-	-
2-550S162-54	3′-8″	3′-2″	2′-8″	2′-3″	-	2′-10″	2′-3″	-	-	-
2-550S162-68	4′-9″	4′-4″	3′-11″	3′-6″	3′-2″	4′-0″	3′-6″	3′-1″	2′-9″	2′-4″
2-550S162-97	6′-3″	5′-9″	5′-4″	5′-0″	4′-8″	5′-6″	5′-0″	4′-7″	4′-3″	3′-11″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	2′-11″	2′-0″	-	-	-	-	-	-	-	-
2-800S162-54	4′-9″	4′-2″	3′-7″	3′-1″	2′-7″	3′-9″	3′-1″	2′-5″	-	-
2-800S162-68	6′-4″	5′-9″	5′-3″	4′-9″	4′-4″	5′-4″	4′-9″	4′-3″	3′-10″	3′-4″
2-800S162-97	8′-5″	7′-9″	7′-3″	6′-9″	6′-4″	7′-4″	6′-9″	6′-3″	5′-10″	5′-5″
2-1000S162-43	3′-4″	2′-5″	-	-	-	-	-	-	-	-
2-1000S162-54	5′-6″	4′-10″	4′-2″	3′-7″	3′-0″	4′-4″	3′-7″	2′-11″	2′-2″	-
2-1000S162-68	7′-4″	6′-8″	6′-1″	5′-7″	5′-1″	6′-3″	5′-7″	5′-0″	4′-5″	4′-0″
2-1000S162-97	9′-11″	8′-3″	8′-7″	8′-1″	7′-7″	8′-9″	8′-1″	7′-6″	7′-0″	6′-6″
2-1200S162-54	5′-6″	4′-10″	4′-4″	3′-11″	3′-5″	4′-5″	3′-11″	3′-3″	2′-6″	-
2-1200S162-68	8′-2″	7′-5″	6′-9″	6′-3″	5′-8″	6′-11″	6′-3″	5′-7″	5′-0″	4′-6″
2-1200S162-97	10′-10″	10′-2″	9′-8″	9′-2″	8′-7″	9′-9″	9′-2″	8′-6″	7′-11″	7′-5″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
Second floor dead load is 10 psf.
Roof/Ceiling dead load is 12 psf.
Second floor live load is 30 psf
Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE R603.6(20)
BACK-TO-BACK HEADER SPANS Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)[a, b]

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf) Building width[c] (feet)					GROUND SNOW LOAD (70 psf) Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	2′-6″	2′-0″	-	-	-	-	-	-	-	-
2-350S162-54	3′-8″	3′-3″	2′-11″	2′-7″	2′-3″	3′-0″	2′-7″	2′-2″	-	-
2-350S162-68	4′-7″	4′-5″	4′-1″	3′-9″	3′-6″	4′-2″	3′-9″	3′-5″	3′-1″	2′-10″
2-350S162-97	5′-1″	4′-10″	4′-8″	4′-6″	4′-5″	4′-10″	4′-7″	4′-5″	4′-3″	4′-1″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	3′-11″	3′-5″	2′-11″	2′-5″	-	3′-0″	2′-5″	-	-	-
2-550S162-54	5′-7″	5′-0″	4′-7″	4′-2″	3′-9″	4′-8″	4′-2″	3′-8″	3′-3″	2′-11″
2-550S162-68	6′-7″	6′-4″	5′-11″	5′-6″	5′-1″	6′-0″	5′-6″	5′-0″	4′-7″	4′-3″
2-550S162-97	7′-4″	7′-0″	6′-9″	6′-6″	6′-4″	6′-11″	6′-8″	6′-5″	6′-2″	6′-0″
2-800S162-33	1′-11″	-	-	-	-	-	-	-	-	-
2-800S162-43	4′-2″	3′-8″	3′-4″	3′-0″	2′-6″	3′-5″	3′-0″	2′-4″	-	-
2-800S162-54	6′-7″	5′-11″	5′-5″	4′-11″	4′-6″	5′-6″	4′-11″	4′-5″	3′-11″	3′-6″
2-800S162-68	8′-3″	7′-8″	7′-1″	6′-8″	6′-2″	7′-3″	6′-7″	6′-1″	5′-7″	5′-2″
2-800S162-97	9′-11″	9′-6″	9′-2″	8′-10″	8′-7″	9′-5″	9′-0″	8′-7″	8′-2″	7′-9″
2-1000S162-43	3′-4″	2′-11″	2′-7″	2′-5″	2′-2″	2′-8″	2′-5″	2′-2″	1′-11″	-
2-1000S162-54	6′-7″	5′-10″	5′-3″	4′-9″	4′-4″	5′-4″	4′-9″	4′-3″	3′-10″	3′-6″
2-1000S162-68	9′-4″	8′-9″	8′-1″	7′-7″	7′-1″	8′-3″	7′-7″	6′-11″	6′-5″	5′-11″
2-1000S162-97	11′-7″	10′-11″	10′-4″	9′-10″	9′-5″	10′-5″	9′-10″	9′-3″	8′-10″	8′-5″
2-1200S162-54	5′-6″	4′-10″	4′-4″	3′-11″	3′-7″	4′-5″	3′-11″	3′-6″	3′-2″	2′-11″
2-1200S162-68	10′-4″	9′-8″	8′-8″	7′-11″	7′-2″	8′-11″	7′-11″	7′-1″	6′-5″	5′-10″
2-1200S162-97	12′-11″	12′-2″	11′-6″	11′-0″	10′-6″	11′-8″	11′-0″	10′-5″	9′-10″	9′-5″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criterion: L/360 for live loads, L/240 for total loads.
b. Design load assumptions:
Second floor dead load is 10 psf.
Roof/Ceiling dead load is 12 psf.
Second floor live load is 30 psf
Attic live load is 10 psf.
c. Building width is in the direction of horizontal framing members supported by the header.

~~TABLE R603.6(21)~~
~~BACK-TO-BACK HEADER SPANS Headers Supporting Two Floors, Roof and Ceiling (33 ksi steel)~~[~~a, b~~]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width~~[~~c~~] ~~(feet)~~					~~Building width~~[~~c~~] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-68~~	~~2′-5″~~	-	-	-	-	~~2′-4″~~	-	-	-	-
~~2-350S162-97~~	~~3′-6″~~	~~3′-2″~~	~~2′-10″~~	~~2′-6″~~	~~2′-3″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-6″~~	~~2′-3″~~
~~2-550S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-54~~	~~2′-6″~~	-	-	-	-	~~2′-5″~~	-	-	-	-
~~2-550S162-68~~	~~3′-9″~~	~~3′-3″~~	~~2′-9″~~	~~2′-4″~~	-	~~3′-8″~~	~~3′-2″~~	~~2′-9″~~	~~2′-4″~~	-
~~2-550S162-97~~	~~5′-3″~~	~~4′-9″~~	~~4′-4″~~	~~3′-11″~~	~~3′-8″~~	~~5′-2″~~	~~4′-8″~~	~~4′-3″~~	~~3′-11″~~	~~3′-7″~~
~~2-800S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-54~~	~~3′-5″~~	~~2′-8″~~	-	-	-	~~3′-4″~~	~~2′-7″~~	-	-	-
~~2-800S162-68~~	~~5′-1″~~	~~4′-5″~~	~~3′-11″~~	~~3′-4″~~	~~2′-11″~~	~~5′-0″~~	~~4′-4″~~	~~3′-10″~~	~~3′-4″~~	~~2′-10″~~
~~2-800S162-97~~	~~7′-0″~~	~~6′-5″~~	~~5′-11″~~	~~5′-5″~~	~~5′-0″~~	~~7′-0″~~	~~6′-4″~~	~~5′-10″~~	~~5′-5″~~	~~5′-0″~~
~~2-1000S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-1000S162-54~~	~~3′-11″~~	~~3′-1″~~	~~2′-3″~~	-	-	~~3′-10″~~	~~3′-0″~~	~~2′-2″~~	-	-
~~2-1000S162-68~~	~~5′-10″~~	~~5′-2″~~	~~4′-6″~~	~~4′-0″~~	~~3′-5″~~	~~5′-9″~~	~~5′-1″~~	~~4′-6″~~	~~3′-11″~~	~~3′-4″~~
~~2-1000S162-97~~	~~8′-5″~~	~~7′-8″~~	~~7′-1″~~	~~6′-6″~~	~~6′-1″~~	~~8′-4″~~	~~7′-7″~~	~~7′-0″~~	~~6′-6″~~	~~6′-0″~~
~~2-1200S162-54~~	~~4′-2″~~	~~3′-6″~~	~~2′-7″~~	-	-	~~4′-1″~~	~~3′-5″~~	~~2′-6″~~	-	-
~~2-1200S162-68~~	~~6′-6″~~	~~5′-9″~~	~~5′-1″~~	~~4′-6″~~	~~3′-11″~~	~~6′-6″~~	~~5′-8″~~	~~5′-0″~~	~~4′-5″~~	~~3′-10″~~
~~2-1200S162-97~~	~~9′-5″~~	~~8′-8″~~	~~8′-0″~~	~~7′-5″~~	~~6′-11″~~	~~9′-5″~~	~~8′-7″~~	~~7′-11″~~	~~7′-4″~~	~~6′-10″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~
~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~
~~c. Building width is in the direction of horizontal framing members supported by the header~~

~~TABLE R603.6(22)~~
~~BACK-TO-BACK HEADER SPANS Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)~~~~[a, b]~~

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (20 psf)~~					~~GROUND SNOW LOAD (30 psf)~~				
	~~Building width[c] (feet)~~					~~Building width[c] (feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-43~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-350S162-54~~	~~2′-9″~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~	~~2′-8″~~	~~2′-3″~~	~~-~~	~~-~~	~~-~~
~~2-350S162-68~~	~~3′-11″~~	~~3′-6″~~	~~3′-2″~~	~~2′-10″~~	~~2′-6″~~	~~3′-11″~~	~~3′-6″~~	~~3′-1″~~	~~2′-9″~~	~~2′-6″~~
~~2-350S162-97~~	~~4′-9″~~	~~4′-6″~~	~~4′-4″~~	~~4′-1″~~	~~3′-10″~~	~~4′-8″~~	~~4′-6″~~	~~4′-4″~~	~~4′-1″~~	~~3′-9″~~
~~2-550S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-43~~	~~2′-9″~~	~~2′-0″~~	~~-~~	~~-~~	~~-~~	~~2′-8″~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-550S162-54~~	~~4′-5″~~	~~3′-10″~~	~~3′-4″~~	~~2′-11″~~	~~2′-5″~~	~~4′-4″~~	~~3′-9″~~	~~3′-3″~~	~~2′-10″~~	~~2′-5″~~
~~2-550S162-68~~	~~5′-8″~~	~~5′-2″~~	~~4′-8″~~	~~4′-3″~~	~~3′-11″~~	~~5′-8″~~	~~5′-1″~~	~~4′-8″~~	~~4′-3″~~	~~3′-10″~~
~~2-550S162-97~~	~~6′-10″~~	~~6′-6″~~	~~6′-3″~~	~~6′-0″~~	~~5′-7″~~	~~6′-9″~~	~~6′-5″~~	~~6′-3″~~	~~5′-11″~~	~~5′-6″~~
~~2-800S162-33~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-800S162-43~~	~~3′-2″~~	~~2′-7″~~	~~-~~	~~-~~	~~-~~	~~3′-1″~~	~~2′-6″~~	~~-~~	~~-~~	~~-~~
~~2-800S162-54~~	~~5′-2″~~	~~4′-7″~~	~~4′-0″~~	~~3′-6″~~	~~3′-0″~~	~~5′-2″~~	~~4′-6″~~	~~3′-11″~~	~~3′-5″~~	~~2′-11″~~
~~2-800S162-68~~	~~6′-11″~~	~~6′-3″~~	~~5′-8″~~	~~5′-2″~~	~~4′-9″~~	~~6′-10″~~	~~6′-2″~~	~~5′-7″~~	~~5′-2″~~	~~4′-8″~~
~~2-800S162-97~~	~~9′-3″~~	~~8′-8″~~	~~8′-3″~~	~~7′-9″~~	~~7′-4″~~	~~9′-2″~~	~~8′-8″~~	~~8′-2″~~	~~7′-9″~~	~~7′-4″~~
~~2-1000S162-43~~	~~2′-6″~~	~~2′-2″~~	~~2′-0″~~	~~-~~	~~-~~	~~2′-6″~~	~~2′-2″~~	~~1′-11″~~	~~-~~	~~-~~
~~2-1000S162-54~~	~~5′-0″~~	~~4′-4″~~	~~3′-11″~~	~~3′-6″~~	~~3′-2″~~	~~4′-11″~~	~~4′-4″~~	~~3′-10″~~	~~3′-6″~~	~~3′-2″~~
~~2-1000S162-68~~	~~7′-10″~~	~~7′-2″~~	~~6′-6″~~	~~5′-11″~~	~~5′-6″~~	~~7′-9″~~	~~7′-1″~~	~~6′-5″~~	~~5′-11″~~	~~5′-5″~~
~~2-1000S162-97~~	~~10′-1″~~	~~9′-5″~~	~~8′-11″~~	~~8′-6″~~	~~8′-0″~~	~~10′-0″~~	~~9′-5″~~	~~8′-10″~~	~~8′-5″~~	~~7′-11″~~
~~2-1200S162-54~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~2-1200S162-68~~	~~7′-4″~~	~~6′-8″~~	~~6′-1″~~	~~5′-6″~~	~~5′-1″~~	~~7′-3″~~	~~6′-7″~~	~~6′-0″~~	~~5′-6″~~	~~5′-0″~~
~~2-1200S162-97~~	~~9′-5″~~	~~8′-8″~~	~~8′-1″~~	~~7′-6″~~	~~7′-1″~~	~~9′-4″~~	~~8′-8″~~	~~8′-0″~~	~~7′-6″~~	~~7′-0″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header~~

~~TABLE R603.6(23)~~

~~BACK-TO-BACK HEADER SPANS Headers Supporting Two Floors, Roof and ceiling (33 ksi steel)~~[a, b]

~~MEMBER DESIGNATION~~	~~GROUND SNOW LOAD (50 psf)~~					~~GROUND SNOW LOAD (70 psf)~~				
	~~Building width~~[c] ~~(feet)~~					~~Building width~~[c] ~~(feet)~~				
	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~	~~24~~	~~28~~	~~32~~	~~36~~	~~40~~
~~2-350S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-54~~	-	-	-	-	-	-	-	-	-	-
~~2-350S162-68~~	~~2′-2″~~	-	-	-	-	-	-	-	-	-
~~2-350S162-97~~	~~3′-3″~~	~~3′-0″~~	~~2′-8″~~	~~2′-4″~~	~~2′-1″~~	~~3′-1″~~	~~2′-9″~~	~~2′-6″~~	~~2′-2″~~	-
~~2-550S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-550S162-54~~	~~2′-2″~~	-	-	-	-	-	-	-	-	-
~~2-550S162-68~~	~~3′-6″~~	~~3′-0″~~	~~2′-6″~~	~~2′-1″~~	-	~~3′-2″~~	~~2′-9″~~	~~2′-3″~~	-	-
~~2-550S162-97~~	~~5′-0″~~	~~4′-6″~~	~~4′-1″~~	~~3′-9″~~	~~3′-5″~~	~~4′-8″~~	~~4′-3″~~	~~3′-11″~~	~~3′-7″~~	~~3′-3″~~
~~2-800S162-33~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-800S162-54~~	~~3′-0″~~	~~2′-3″~~	-	-	-	~~2′-7″~~	-	-	-	-
~~2-800S162-68~~	~~4′-9″~~	~~4′-2″~~	~~3′-7″~~	~~3′-1″~~	~~2′-7″~~	~~4′-5″~~	~~3′-10″~~	~~3′-3″~~	~~2′-9″~~	~~2′-3″~~
~~2-800S162-97~~	~~6′-9″~~	~~6′-1″~~	~~5′-7″~~	~~5′-2″~~	~~4′-9″~~	~~6′-4″~~	~~5′-10″~~	~~5′-4″~~	~~4′-11″~~	~~4′-7″~~
~~2-1000S162-43~~	-	-	-	-	-	-	-	-	-	-
~~2-1000S162-54~~	~~3′-6″~~	~~2′-8″~~	-	-	-	~~3′-1″~~	~~2′-2″~~	-	-	-
~~2-1000S162-68~~	~~5′-6″~~	~~4′-10″~~	~~4′-2″~~	~~3′-7″~~	~~3′-1″~~	~~5′-1″~~	~~4′-6″~~	~~3′-10″~~	~~3′-4″~~	~~2′-9″~~
~~2-1000S162-97~~	~~8′-0″~~	~~7′-4″~~	~~6′-9″~~	~~6′-3″~~	~~5′-9″~~	~~7′-7″~~	~~7′-0″~~	~~6′-5″~~	~~5′-11″~~	~~5′-6″~~
~~2-1200S162-54~~	~~3′-11″~~	~~3′-0″~~	~~2′-0″~~	-	-	~~3′-5″~~	~~2′-6″~~	-	-	-
~~2-1200S162-68~~	~~6′-2″~~	~~5′-5″~~	~~4′-9″~~	~~4′-1″~~	~~3′-6″~~	~~5′-9″~~	~~5′-0″~~	~~4′-4″~~	~~3′-9″~~	~~3′-2″~~
~~2-1200S162-97~~	~~9′-1″~~	~~8′-4″~~	~~7′-8″~~	~~7′-1″~~	~~6′-7″~~	~~8′-8″~~	~~7′-11″~~	~~7′-4″~~	~~6′-9″~~	~~6′-3″~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~

~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header~~

~~TABLE R603.6(24)~~
~~BACK-TO-BACK HEADER SPANS Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)[a, b]~~

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width[c] (feet)					Building width[c] (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	-	-	-	-	-	-	-	-	-	-
2-350S162-43	-	-	-	-	-	-	-	-	-	-
2-350S162-54	2′-6″	2′-1″	-	-	-	2′-3″	-	-	-	-
2-350S162-68	3′-9″	3′-4″	2′-11″	2′-7″	2′-4″	3′-6″	3′-1″	2′-9″	2′-5″	2′-2″
2-350S162-97	4′-6″	4′-4″	4′-2″	3′-11″	3′-8″	4′-4″	4′-2″	4′-0″	3′-9″	3′-6″
2-550S162-33	-	-	-	-	-	-	-	-	-	-
2-550S162-43	2′-5″	-	-	-	-	-	-	-	-	-
2-550S162-54	4′-1″	3′-7″	3′-1″	2′-7″	2′-2″	3′-10″	3′-3″	2′-10″	2′-4″	-
2-550S162-68	5′-5″	4′-11″	4′-5″	4′-0″	3′-8″	5′-1″	4′-7″	4′-2″	3′-10″	3′-5″
2-550S162-97	6′-5″	6′-2″	5′-11″	5′-9″	5′-4″	6′-3″	6′-0″	5′-9″	5′-6″	5′-2″
2-800S162-33	-	-	-	-	-	-	-	-	-	-
2-800S162-43	2′-11″	2′-2″	-	-	-	2′-6″	-	-	-	-
2-800S162-54	4′-11″	4′-3″	3′-8″	3′-2″	2′-8″	4′-6″	3′-11″	3′-5″	2′-11″	2′-4″
2-800S162-68	6′-7″	5′-11″	5′-4″	4′-11″	4′-6″	6′-2″	5′-7″	5′-1″	4′-8″	4′-3″
2-800S162-97	8′-9″	8′-5″	7′-11″	7′-6″	7′-0″	8′-5″	8′-1″	7′-9″	7′-3″	6′-10″
2-1000S162-43	2′-4″	2′-1″	-	-	-	2′-2″	1′-11″	-	-	-
2-1000S162-54	4′-8″	4′-1″	3′-8″	3′-3″	3′-0″	4′-4″	3′-10″	3′-5″	3′-1″	2′-9″
2-1000S162-68	7′-6″	6′-9″	6′-2″	5′-8″	5′-2″	7′-1″	6′-5″	5′-10″	5′-4″	4′-11″
2-1000S162-97	9′-9″	9′-2″	8′-7″	8′-2″	7′-8″	9′-5″	8′-10″	8′-5″	7′-11″	7′-5″
2-1200S162-54	-	-	-	-	-	-	-	-	-	-
2-1200S162-68	7′-0″	6′-4″	5′-9″	5′-3″	4′-9″	6′-7″	6′-0″	5′-5″	5′-0″	4′-6″
2-1200S162-97	9′-1″	8′-4″	7′-9″	7′-3″	6′-9″	8′-8″	8′-0″	7′-6″	7′-0″	6′-7″

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.~~

~~a. Deflection criterion: L/360 for live loads, L/240 for total loads.~~

~~b. Design load assumptions:~~
~~Second floor dead load is 10 psf.~~
~~Roof/Ceiling dead load is 12 psf.~~
~~Second floor live load is 40 psf~~
~~Third floor live load is 30 psf.~~
~~Attic live load is 10 psf.~~

~~c. Building width is in the direction of horizontal framing members supported by the header~~

R603.7 Jack and king studs. The number of jack and king studs installed on each side of a header shall comply with Table R603.7(1). King, jack and cripple studs shall be of the same dimension and thickness as the adjacent wall studs. Headers shall be connected to king studs in accordance with Table R603.7(2) and the following provisions:

1. For box beam headers, one-half of the total number of required screws shall be applied to the header and one half to the king stud by use of C-shaped or track member in accordance with Figure R603.6(1). The track or C-shape sections shall extend the depth of the header minus $^{1}/_{2}$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs.
2. For back-to-back headers, one-half the total number of screws shall be applied to the header and one-half to the king stud by use of a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle in

accordance with Figure R603.6(2). The clip angle shall extend the depth of the header minus $^1/_2$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs. Jack and king studs shall be interconnected with structural sheathing in accordance with Figures R603.6(1) and R603.6(2).

TABLE R603.7(1)
TOTAL NUMBER OF JACK AND KING STUDS REQUIRED AT EACH END OF AN OPENING

SIZE OF OPENING (feet-inches)	24″ O.C. STUD SPACING		16″ O.C. STUD SPACING	
	No. of jack studs	No. of king studs	No. of jack studs	No. of king studs
Up to 3′-6″	1	1	1	1
> 3′-6″ to 5′-0″	1	2	1	2
> 5′-0″ to 5′-6″	1	2	2	2
> 5′-6″ to 8′-0″	1	2	2	2
> 8′-0″ to 10′-6″	2	2	2	3
> 10′-6" to 12′-0″	2	2	3	3
> 12′-0″ to 13′-0″	2	3	3	3
> 13′-0″ to 14′-0″	2	3	3	4
> 14′-0″ to 16′-0″	2	3	3	4
> 16′-0″ to 18′-0″	3	3	4	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

TABLE R603.7(2)
HEADER TO KING STUD CONNECTION REQUIREMENTS[a, b, c, d]

HEADER SPAN (feet)	ULTIMATE ~~BASIC~~ WIND SPEED (mph), EXPOSURE CATEGORY		
	~~85 B or Seismic Design Categories A, B, C, D_0, D_1 and D_2~~	~~85~~110, Exposure Category **C or less than** ~~110~~139, Exposure Category **B**	**Less than** ~~110~~139, Exposure Category **C**
≤ 4′	~~4-No. 8 screws~~	4-No. 8 screws	6-No. 8 screws
> 4′ to 8′	~~4-No. 8 screws~~	4-No. 8 screws	8-No. 8 screws
> 8′ to 12′	~~4-No. 8 screws~~	6-No. 8 screws	10-No. 8 screws
> 12′ to 16′	~~4-No. 8 screws~~	8-No. 8 screws	12-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 4.448 N.

a. All screw sizes shown are minimum.
b. For headers located on the first floor of a two-story building or the first or second floor of a three-story building, the total number of screws is permitted to be reduced by 2 screws, but the total number of screws shall be no less than 4.
c. For roof slopes of 6:12 or greater, the required number of screws may be reduced by half, but the total number of screws shall be no less than four.
d. Screws can be replaced by an uplift connector which has a capacity of the number of screws multiplied by 164 pounds (e.g., 12-No. 8 screws can be replaced by an uplift connector whose capacity exceeds 12 x 164 pounds = 1,968 pounds).

R603.8 Head and sill track. Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table R603.8. For openings less than 4 feet (1219 mm) in height that have both a head track and a sill track, multiplying the spans by 1.75 shall be permitted in Table R603.8. For openings less than or equal to 6 feet (1829 mm) in height that have both a head track and a sill track, multiplying the spans in Table R603.8 by 1.50 shall be permitted.

TABLE R603.8
HEAD AND SILL TRACK SPAN ~~F_y = 33 ksi~~

~~BASIC~~ ULTIMATE WIND SPEED (mph) AND EXPOSURE CATEGORY		ALLOWABLE HEAD AND SILL TRACK SPAN[a,b,c] (ft-in.)					
		TRACK DESIGNATION[d]					
B	C	350T125-33	350T125-43	350T125-54	550T125-33	550T125-43	550T125-54
~~85~~	~~-~~	~~5′-0″~~	~~5′-7″~~	~~6′-2″~~	~~5′-10″~~	~~6′-8″~~	~~7′-0″~~
~~90~~115	-	4′-10″	5′-5″	6′-0″	5′-8″	6′-3″	6′-10″
~~100~~126	~~85~~110	4′-6″	5′-1″	5′-8″	5′-4″	5′-11″	6′-5″
~~110~~<139	~~90~~115	4′-2″	4′-9″	5′-4″	5′-1″	5′-7″	6′-1″
~~120~~	~~100~~126	3′-11″	4′-6″	5′-0″	4′-10″	5′-4″	5′-10″
~~130~~	~~110~~<139	3′-8″	4′-2″	4′-9″	4′-1″	5′-1″	5′-7″
~~140~~	~~120~~	~~3′-7″~~	~~4′-1″~~	~~4′-7″~~	~~3′-6″~~	~~4′-11″~~	~~5′-5″~~
~~150~~	~~130~~	~~3′-5″~~	~~3′-10″~~	~~4′-4″~~	~~2′-11″~~	~~4′-7″~~	~~5′-2″~~
~~-~~	~~140~~	~~3′-1″~~	~~3′-6″~~	~~4′-1″~~	~~2′-3″~~	~~4′-0″~~	~~4′-10″~~
~~-~~	~~150~~	~~2′-9″~~	~~3′-4″~~	~~3′-10″~~	~~2′-0″~~	~~3′-7″~~	~~4′-7″~~

For Si: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Deflection limit: *L/240.*
b. Head and sill track spans are based on components and cladding wind pressures~~speeds~~ and 48 inch tributary span.
c. For openings less than 4 feet in height that have both a head track and sill track, the above spans are permitted to be multiplied by 1.75. For openings less than or equal to 6 feet in height that have both a head track and sill track, the above spans are permitted to be multiplied by a factor of 1.5.
d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

R603.9 Structural sheathing. Structural sheathing shall be installed in accordance with Figure R603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.

R603.9.1 Sheathing materials. Structural sheathing panels shall consist of minimum $^{7}/_{16}$-inch-thick (11 mm) oriented strand board or $^{15}/_{32}$-inch-thick (12 mm) plywood.

R603.9.2 Determination of minimum length of full height sheathing. The minimum length of full height sheathing on each *braced wall line* shall be determined by multiplying the length of the *braced wall line* by the percentage obtained from Table R603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table R603.9.2(2). The minimum length of full height sheathing shall not be less than 20 percent of the *braced wall line* length.

To be considered full height sheathing, structural sheathing shall extend from the bottom to the top of the wall without interruption by openings. Only sheathed, full height wall sections, uninterrupted by openings, which are a minimum of 48 inches (1219 mm) wide, shall be counted toward meeting the minimum percentages in Table R603.9.2(1). In addition, structural sheathing shall comply with all of the following requirements:

1. Be installed with the long dimension parallel to the stud framing (i.e., vertical orientation) and shall cover the full vertical height of wall from the bottom of the bottom track to the top of the top track of each *story*. Installing the long dimension perpendicular to the stud framing or using shorter segments shall be permitted provided that the horizontal joint is blocked as described in Item 2.
2. Be blocked when the long dimension is installed perpendicular to the stud framing (i.e., horizontal orientation). Blocking shall be a minimum of 33 mil (0.84 mm) thickness. Each horizontal structural sheathing panel shall be fastened with No. 8 screws spaced at 6 inches (152 mm) on center to the blocking at the joint.

3. Be applied to each end (corners) of each of the exterior walls with a minimum 48-inch-wide (1219 mm) panel.

R603.9.2.1 Full height sheathing. The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for 9-foot-high (2743 mm) walls and multiplied by 1.20 for 10-foot-high (3048 mm) walls.

R603.9.2.2 ~~**Full height sheathing in hip roof homes.** For hip roofed homes, the minimum percentages of full height sheathing in Table R603.9.2(1), based upon wind, shall be permitted to be multiplied by a factor of 0.95 for roof slopes not exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.~~

~~**R603.9.2.3**~~ **Full height sheathing in lowest story.** In the lowest *story* of a *dwelling*, multiplying the percentage of full height sheathing required in Table R603.9.2(1) by 0.6, shall be permitted provided hold down anchors are provided in accordance with Section R603.9.4.2.

FIGURE R603.9.4.2 CORNER STUD HOLD DOWN DETAIL

(Figure remains unchanged)

TABLE R603.9.2(1)
MINIMUM PERCENTAGE OF FULL HEIGHT STRUCTURAL SHEATHING ON EXTERIOR WALLS[a,b]

WALL SUPPORTING	ROOF SLOPE	ULTIMATE ~~BASIC~~ WIND SPEED AND EXPOSURE CATEGORY (mph)					
		~~85 B~~	~~90~~115 B	~~100~~126 B ~~85~~110 C	< ~~110~~139 B ~~90~~115C	~~100~~126C	< ~~110~~139 C
Roof and ceiling only (One story or top floor of two or three story building)	3:12	~~8~~	9	9	12	16	20
	6:12	~~12~~	13	15	20	26	35
	9:12	~~21~~	23	25	30	50	58
	12:12	~~30~~	33	35	40	66	75
One story, roof and ceiling (First floor of a two-story building or second floor of a three story building)	3:12	~~24~~	27	30	35	50	66
	6:12	~~25~~	28	30	40	58	74
	9:12	~~35~~	38	40	55	74	91
	12:12	~~40~~	45	50	65	100	115
Two story, roof and ceiling (First floor of a three story building)	3:12	~~40~~	45	51	58	84	112
	6:12	~~38~~	43	45	60	90	113
	9:12	~~49~~	53	55	80	98	124
	12:12	~~50~~	57	65	90	134	155

For SI: 1 mile per hour = 0.447 m/s.

a. Linear interpolation is permitted.

b. For hip-roofed homes the minimum percentage of full height sheathing, based upon wind, is permitted to be multiplied by a factor of 0.95 for roof slopes not exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.

TABLE R603.9.2(2)
FULL HEIGHT SHEATHING LENGTH ADJUSTMENT FACTORS

PLAN ASPECT RATIO	LENGTH ADJUSTMENT FACTORS	
	Short wall	Long wall
1:1	1.0	1.0
1.5:1	1.5	0.67
2:1	2.0	0.50
3:1	3.0	0.33
4:1	4.0	0.25

R603.9.3 Structural sheathing fastening. All edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure R603.9 and Table R603.3.2(1). Screws for attachment of structural sheathing panels shall be bugle-head, flat-head, or similar head style with a minimum head diameter of 0.29 inch (8 mm).

For continuously-sheathed *braced wall lines* using wood structural panels installed with No. 8 screws spaced 4-inches (102 mm) on center at all panel edges and 12 inches (304.8 mm) on center on intermediate framing members, the following shall apply:

1. Multiplying the percentages of full height sheathing in Table R603.9.2(1) by 0.72 shall be permitted.
2. For bottom track attached to foundations or framing below, the bottom track anchor or screw connection spacing in Table R505.3.1(1) and Table R603.3.1 shall be multiplied by two-thirds.

R603.9.4 Uplift connection requirements. Uplift connections shall be provided in accordance with this section.

R603.9.4.1 Ultimate design wind speeds greater than 100 126 mph. Where ultimate design wind speeds ~~are in excess~~ of exceed ~~100~~126 miles per hour (56~~45~~ m/s), Exposure Category C, walls shall be provided ~~wind~~ with direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F7.2, as required for ~~110~~139 miles per hour (62~~49~~ m/s), Exposure Category C.

R603.9.4.2 Hold-down anchor. Where the percentage of full height sheathing is adjusted in accordance with Section ~~R603.9.2.3~~, R603.9.2.2 a hold-down anchor, with a strength of 4,300 pounds (19 kN), shall be provided at each end of each full-height sheathed wall section used to meet the minimum percent sheathing requirements of Section R603.9.2. Hold-down anchors shall be attached to back-to-back studs; structural sheathing panels shall have edge fastening to the studs, in accordance with Section R603.9.3 and AISI S230, Table E11-1.

A single hold-down anchor, installed in accordance with Figure R603.9.4.2, shall be permitted at the corners of buildings.

R603.9.5 Structural sheathing for stone and masonry veneer. In Seismic Design Category C, where stone and masonry veneer is installed in accordance with Section R703.7, the length of structural sheathing for walls supporting one *story*, roof and ceiling shall be the greater of the amount required by Section R603.9.2 or 36 percent~~,~~ as modified by Section R603.9.2.1 and R603.9.2.2, if applicable ~~except Section R603.9.2.2 shall not be permitted~~.

Revise as follows:

M1308.1 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, ~~R603.2.5~~ R603.2.6 and R804.2.5. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Revise as follows:

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, ~~R603.2.5~~ R603.2.6 and R804.2.5. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.

Revise as follows:

P2603.2 Drilling and notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in Sections R502.8, R602.6, R802.7 and R802.7.1. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, ~~R603.2.5~~ R603.2.6 and R804.2.5. In accordance with the provisions in Sections R505.3.5, R603.3.4 and R804.3.4, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Reason: This proposal is one in a series intended to both update and streamline the cold-formed steel (CFS) light frame construction provisions of the IRC. The revisions are based upon recommendations made by the AISI Committee on Framing Standards (COFS) Prescriptive Methods Subcommittee, which is responsible for the requirements' base document -- AISI S230, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings.* For the most part, the changes are editorial in nature and work to focus the cold-formed steel solutions presented in the IRC on the most popular and readily available options. The changes also align the cold-formed steel provisions with the latest reference standards, including AISI S230-07 w/S3-12, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings,* 2007, with Supplement 3, 2012.

Changes specific to Section R603 include the following:

- **R603:** Title correction.
- **R603.1**: The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial adjustments are made to the language. The design wind speeds are changed based upon the following direct conversion table, which was incorporated into AISI S230-07 w/S3-12:

ASCE 7-10 Wind Speed (mph)	110	115	126	139	152	164	177	190
AISI S230 Wind Speed (mph)	85	90	100	110	120	130	140	150

- **R603.2:** Requirements are relocated to new Section R603.2.3, which is specific to dimension, thickness and material grade.
- **R603.2.1:** The references to ASTM A653 and ASTM A792 are deleted. Since these materials are included under ASTM A1003, they do not need to be repeated in this section.
- **R603.2.2:** The corrosion protection requirements are relocated from Section R603.2.3 for better flow in section.
- **R603.2.3:** Requirements from Section R603.2 are relocated into new section on dimension, thickness and material grade and Table R603.2(1) and Table R603.2(2) are combined into new Table R603.2.3. The minimum flange width, maximum flange width, and minimum lip size are moved into the charging language for the table, since these properties do not vary based upon the member designation. Also, to further streamline the provisions, the most popular and readily available grade-thickness combinations are being retained and the less popular and readily available grade-thickness combinations are being removed. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to Section R603.2.3. Finally, the reference to 97 mil product is deleted. It is very uncommon in residential construction, and, if need be, the user can still use AISI S230, where solutions include 97 mil product.
- **R603.2.5:** The title is fixed to match others in section and the screw substitution factor is eliminated. This is seldom used in prescriptive design and adds complexity to the provisions.
- **Figures R603.2.6.1 and R603.2.6.3:** Title correction.
- **Table R603.3.1:** In Table R603.3.1, the wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the column headings to clarify the applicability of the CFSF provisions. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated. Provisions at this lower wind speed are not substantively different than at the next higher wind speed. Finally, entries on wind uplift connector strength are brought into agreement with AISI S230-07 w/S3-12, which includes the addition of a new Figure R603.3.1(4) – both in the text and in the table notes.
- **Tables R603.3.1.1(1) and R603.1.1(2):** In Tables R603.3.1.1(1) and R603.3.1.1(2), wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the row headings to clarify the applicability of the CFSF provisions. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated. Provisions at this lower wind speed are not substantively different than at the next higher wind speed.
- **R603.3.2, Tables R603.3.2(2) through R603.3.2(16), and Tables R603.3.2.1(1) and R603.3.2.1(2):** In the Section's charging language, Tables R603.3.2(2) through R603.2(16), and Tables R603.3.2.1(1) and R603.3.2.1(2), wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the row headings in the tables to clarify the applicability of the CFSF provisions. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated from all the tables. Provisions at this lower wind speed are not

substantively different than at the next higher wind speed. Also, Tables R603.3.2(3) through R603.3.2(6) incorporate errata where the cells change from 33 mil to 43 mil. The reference to 97 mil product is deleted from all tables. In each situation, the Grades 33ksi and 50 ksi tables are combined into one table, thus retaining the most popular and readily available grade-thickness combinations. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to the table notes in each table. Finally, a cross-reference in Section R603.3.2, Item 2 is corrected.

- **Table R603.3.2(1):** The first row is covered in Section R505 and last row is covered in Section R804. Therefore, both can be deleted. Addition of gypsum board row is to follow what is specified in AISI S230-07 w/S3-12.
- **R603.3.3:** A cross-reference in Section R603.3.3, Item 1 is corrected.
- **R603.6 and Tables R603.6(1) through R603.6(6):** In the Section's charging language and Tables R603.6(1) through R603.6(6), the specific back-to-back header tables are deleted. The back-to-back tables add volume and complexity, but do not provide significant improvement over the box header tables. Instead, users are now permitted to use the box beam header tables for back-to-back headers, which is a conservative solution. Also, the reference to 97 mil product is deleted from all tables. Finally, in each situation, the Grades 33ksi and 50 ksi tables are combined into one table, thus retaining the most popular and readily available grade-thickness combinations. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to the table notes in each table.
- **Table R603.7(2):** The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated from the table. Provisions at this lower wind speed are not substantively different than at the next higher wind speed.
- **Table R603.8:** The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the row headings to clarify the applicability of the CFSF provisions. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated from the table. Provisions at this lower wind speed are not substantively different than at the next higher wind speed. To be consistent with changes in other sections, Table R603.8 now applies to both Grade 33 ksi and Grade 50 ksi. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to a new table note. Please note that, while Grade 50 ksi steel is now required for 54 mil and 68 mil product, no changes are made to the allowable spans, thus resulting in additional conservatism. Finally, a small change is made to correct the terminology used in table note b.
- **R603.9.2.2:** The provisions for full height sheathing in hip roof homes is deleted, since a companion proposal for Section R804 is recommending that the hip roof option be deleted.
- **Table R603.9.2(1):** The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated from all the tables. Provisions at this lower wind speed are not substantively different than at the next higher wind speed.
- **R603.9.4:** In Section R603.9.4.1, the wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial adjustments are made to the language. In Section R603.9.4.2, a cross reference is corrected.
- **R603.9.5:** Changes coordinate with the changes in Section R603.9.2.2.
- **M1308.1, M2101.6, and P2603.2**: Cross-references are updated in each of these sections.

Cost Impact: The code change proposal will not increase the cost of construction.

RB330-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB331– 13
R604.3

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R604.3 Installation. Wood structural panel wall sheathing shall be attached to framing in accordance with Table R602.3(1) or R602.3(3). ~~Wood structural panels marked as Exposure I or Exterior are considered water-repellent sheathing under the code.~~

Reason: Water-repellent sheathing is a term no longer recognized in the IRC. The term now used is weather-resistive barrier. The current provisions of Section R703.2 require a weather-resistive barrier under all products including wood structural panels. Wood structural panels are not recognized as a weather-resistive barrier as the term is currently used in Chapter 7. We ask the committee to approve our proposal to remove the last reference to water-repellent sheathing from the IRC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB331-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB332 – 13

R606.2 , R606.2.1, R606.2.2, R606.2.3, R606.2.4, R606.2.5 (NEW), R606.2.6 (NEW), R606.2.7 (NEW), R606.2.8 (NEW), R606.2.9 (NEW), R606.2.10 (NEW), R606.2.12 (NEW), R606.3, R606.3.4 (NEW), R606.3.4.1 (NEW), R606.3.4.2 (NEW), R606.3.4.3 (NEW), R606.8, R606.11, R606.12, R606.12.3, R606.13, R606.14 (NEW), R606.14.1 (NEW), R606.14.2 (NEW), R606.15, R606.15.1, Table R606.15.1, R607.1.1, R607, R607.1.2, R607.1.3, R607.2.1, R607.2.1.1, R607.2.2, R607.2.2.1, R607.2.2.2, R607.3, R608, R608.1, R608.1.1, R608.1.1.1, R608.1.1.2, R608.1.2, R608.1.2.1, R608.1.2.2, R608.1.2.3, R608.1.3, R608.1.3.1, R608.1.3.2, R608.2, R608.2.1, R608.2.2, R609, R609.1, R609.1.1, Table R609.1.1, R609.1.2, Table R609.1.2, R609.1.3, R609.1.4, R609.1.4.1, R609.1.5, R609.1.5.1, R609.1.5.2, R609.2, R609.2.1, R609.2.2, R609.2.3, R609.3, R609.3.1, R609.4, R609.4.1, Chapter 44

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

R606.2 Masonry construction materials.

R606.2.1 Concrete masonry units. Concrete masonry units shall conform to the following standards: ASTM C55 for concrete brick; ASTM C73 for calcium silicate face brick; ASTM C90 for load-bearing concrete masonry units; ASTM C744 for prefaced concrete and calcium silicate masonry units or ASTM C1634 for concrete facing brick.

R606.2.2 Clay or shale masonry units. Clay or shale masonry units shall conform to the following standards: ASTM C34 for structural clay *load-bearing wall* tile; ASTM C56 for structural clay nonload-bearing wall tile; ASTM C62 for building brick (solid masonry units made from clay or shale); ASTM C1088 for solid units of thin veneer brick; ASTM C126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C212 for structural clay facing tile; ASTM C216 for facing brick (solid masonry units made from clay or shale); ASTM C652 for hollow brick (hollow masonry units made from clay or shale) or ASTM C1405 for glazed brick (single-fired solid brick units).

> **Exception:** Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Section R302.

R606.2.3 AAC masonry. AAC masonry units shall conform to ASTM C1386 for the strength class specified.

R606.2.4 Stone masonry units. Stone masonry units shall conform to the following standards: ASTM C503 for marble building stone (exterior); ASTM C568 for limestone building stone; ASTM C615 for granite building stone; ASTM C616 for sandstone building stone; or ASTM C629 for slate building stone.

R606.2.5 Architectural cast stone. Architectural cast stone shall conform to ASTM C1364.

R606.2.6 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

R606.2.7 Mortar. Except for mortars listed in Sections R606.2.8, R606.2.9, and R606.2.10, mortar for use in masonry construction shall meet the proportion specifications of Table R606.2.7 or the property specifications of ASTM C270. The type of mortar shall be in accordance with Sections R606.2.7.1, R606.2.7.2, and R606.2.7.3.

~~R607.1.1~~ R606.2.7.1 Foundation walls. ~~Masonry~~ Mortar for masonry foundation walls constructed as set forth in Tables R404.1.1(1) through R404.1.1(4) ~~and mortar~~ shall be Type M or S mortar.

~~R607.1.2~~ R606.2.7.2 Masonry in Seismic Design Categories A, B and C. Mortar for masonry serving as the lateral-force-resisting system in Seismic Design Categories A, B and C shall be Type M, S or N mortar.

~~R607.1.3~~ R606.2.7.3 Masonry in Seismic Design Categories D_0, D_1 and D_2. Mortar for masonry serving as the lateral-force-resisting system in Seismic Design Categories D_0, D_1 and D_2 shall be Type M or S Portland cement-lime or mortar cement mortar.

TABLE ~~R607.~~1 R606.2.7
MORTAR PROPORTIONS[a, b]

		PROPORTIONS BY VOLUME (cementitious materials)								
MORTAR	TYPE	Portland cement or blended cement	Mortar cement			Masonry cement			Hydrated lime[c] or lime putty	Aggregate ratio (measured in damp, loose conditions)
			M	S	N	M	S	N		
Cement-lime	M	1	—	—	—	—	—	—	$^1/_4$	Not less than $2^1/_4$ and not more than 3 times the sum of separate volumes of lime, if used, and cement
	S	1	—	—	—	—	—	—	over $^1/_4$ to $^1/_2$	
	N	1	—	—	—	—	—	—	over $^1/_2$ to $1^1/_4$	
	O	1	—	—	—	—	—	—	over $1^1/_4$ to $2^1/_2$	
Mortar cement	M	1	—	—	1	—	—	—	—	
	M	—	1	—	—	—	—	—		
	S	$^1/_2$	—	—	1	—	—	—		
	S	—	—	1	—	—	—	—		
	N	—	—	—	1	—	—	—		
	O	—	—	—	1	—	—	—		
Masonry cement	M	1				—	—	1	—	
	M	—				1	—	—		
	S	$^1/_2$				—	—	1		
	S	—				—	1	—		
	N	—				—	—	1		
	O	—				—	—	1		

For SI: 1 cubic foot = 0.0283 m^3, 1 pound = 0.454 kg.

a. For the purpose of these specifications, the weight of 1 cubic foot of the respective materials shall be considered to be as follows:

Portland Cement	94 pounds	Masonry Cement	Weight printed on bag
Mortar Cement	Weight printed on bag	Hydrated Lime	40 pounds
Lime Putty (Quicklime)	80 pounds	Sand, damp and loose	80 pounds of dry sand

b. Two air-entraining materials shall not be combined in mortar.

c. Hydrated lime conforming to the requirements of ASTM C 207.

R606.2.8 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

R606.2.9 Mortar for AAC masonry. Thin-bed mortar for AAC masonry shall comply with Article 2.1 C.1 of TMS 602/ACI 530.1/ASCE 6. Mortar used for the leveling courses of AAC masonry shall comply with Article 2.1 C.2 of TMS 602/ACI 530.1/ASCE 6.

R606.2.10 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 Type S or Type N or shall comply with ANSI A118.4 for latex-modified portland cement mortar.

~~**R609.1.1**~~ **R606.2.11 Grout.** Grout shall consist of cementitious material and aggregate in accordance with ASTM C476 or ~~and~~ the proportion specifications of Table ~~R609.1.~~1 R606.2.11. Type M or Type S mortar to which sufficient water has been added to produce pouring consistency ~~can~~ shall be permitted to be used as grout.

TABLE ~~R609.1.~~1 R606.2.11
GROUT PROPORTIONS BY VOLUME FOR MASONRY CONSTRUCTION

TYPE	PORTLAND CEMENT OR BLENDED CEMENT SLAG CEMENT	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	Coarse
Fine	1	0 to 1/10	$2^1/_4$ to 3 times the sum of the volume of the cementitious materials	—
Coarse	1	0 to 1/10	$2^1/_4$ to 3 times the sum of the volume of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

R606.2.12 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602/ACI 530.1/ASCE 6.

R606.3 Construction requirements.

~~**R607.2.1**~~ **R606.3.1 Bed and head joints.** Unless otherwise required or indicated on the project drawings, head and bed joints shall be 3/8 inch (10 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall not be less than 1/4 inch (7 mm) and not more than 3/4 inch (19 mm).

~~**R607.2.1.1 Mortar joint thickness tolerance.**~~ Mortar joint thickness for load-bearing masonry shall be within the following tolerances from the specified dimensions:

1. Bed joint: + 1/8 inch (3 mm).
2. Head joint: - 1/4 inch (7 mm), + 3/8 inch (10 mm).
3. Collar joints: - 1/4 inch (7 mm), + 3/8 inch (10 mm).

~~**R607.2.2**~~ **R606.3.2 Masonry unit placement.** The mortar shall be sufficiently plastic and units shall be placed with sufficient pressure to extrude mortar from the joint and produce a tight joint. Deep furrowing of bed joints that produces voids shall not be permitted. Any units disturbed to the extent that initial bond is broken after initial placement shall be removed and relaid in fresh mortar. Surfaces to be in contact with mortar shall be clean and free of deleterious materials.

~~**R607.2.2.1**~~ **R606.3.2.1 Solid masonry.** *Solid masonry* units shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled.

~~**R607.2.2.2**~~ **R606.3.2.2 Hollow masonry.** For hollow masonry units, head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell.
~~**R607.3**~~ **R606.3.3 Installation of wall ties.** The installation of wall ties shall be as follows:

1. The ends of wall ties shall be embedded in mortar joints. Wall ties shall have a minimum of 5/8-inch (15.9 mm) mortar coverage from the exposed face.
2. Wall ties shall not be bent after being embedded in grout or mortar.

3. For solid masonry units, solid grouted hollow units, or hollow units in anchored masonry veneer, wall ties shall be embedded in mortar bed at least 11/2 inches (38 mm).
4. For hollow masonry units in other than anchored masonry veneer, wall ties shall engage outer face shells by at least 1/2 inch (13 mm).

~~R606.13~~ R606.3.4 Protection for reinforcement. Bars shall be completely embedded in mortar or grout. Joint reinforcement embedded in horizontal mortar joints shall not have less than 5/8-inch (15.9 mm) mortar coverage from the exposed face. All other reinforcement shall have a minimum coverage of one bar diameter over all bars, but not less than 3/4 inch (19 mm), except where exposed to weather or soil, in which case the minimum coverage shall be 2 inches (51 mm).

~~R606.15.1~~ R606.3.4.1 Corrosion protection. Minimum corrosion protection of joint reinforcement, anchor ties and wire fabric for use in masonry wall construction shall conform to Table ~~R606.15.1~~ R606.3.4.1.

TABLE ~~R606.15.1~~ R606.3.4.1
MINIMUM CORROSION PROTECTION

MASONRY METAL ACCESSORY	STANDARD
Joint reinforcement, interior walls	ASTM A 641, Class 1
Wire ties or anchors in exterior walls completely embedded in mortar or grout	ASTM A 641, Class 3
Wire ties or anchors in exterior walls not completely embedded in mortar or grout	ASTM A 153, Class B-2
Joint reinforcement in exterior walls or interior walls exposed to moist environment	ASTM A 153, Class B-2
Sheet metal ties or anchors exposed to weather	ASTM A 153, Class B-2
Sheet metal ties or anchors completely embedded in mortar or grout	ASTM A 653, Coating Designation G60
Stainless steel hardware for any exposure	ASTM A 167, Type 304

R606.3.4 Grouting requirements.

R606.3.4.1 Grout placement. Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an *approved* alternate method and shall be placed before any initial set occurs and in no case more than 1 1/2 hours after water has been added. Grout shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Grout shall not be pumped through aluminum pipes.

Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table R606.3.4.1. Grout shall be poured in lifts of 8-foot (2438 mm) maximum height. When a total grout pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 64 inches (1626 mm) and special inspection during grouting shall be required. If the work is stopped for one hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout 1 inch (25 mm) below the top.

TABLE ~~R609.1.2~~ R606.3.4.1
GROUT SPACE DIMENSIONS AND POUR HEIGHTS

GROUT TYPE	GROUT POUR MAXIMUM HEIGHT (feet)	MINIMUM WIDTH OF GROUT SPACES[a, b] (inches)	MINIMUM GROUT[b, c] SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS (inches × inches)
Fine	1	0.75	1.5 × 2
	5	2	2 × 3
	12	2.5	2.5 × 3
	24	3	3 × 3
Coarse	1	1.5	1.5 × 3
	5	2	2.5 × 3
	12	2.5	3 × 3
	24	3	3 × 4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. For grouting between masonry wythes.
b. Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the horizontal projection of the diameters of the horizontal bars within the cross section of the grout space.
c. Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

R606.3.4.2 Cleanouts. Provision shall be made for cleaning the space to be grouted. Mortar that projects more than 1/2 inch (13 mm) into the grout space and any other foreign matter shall be removed from the grout space prior to inspection and grouting. Where required by the *building official*, cleanouts shall be provided in the bottom course of masonry for each grout pour when the grout pour height exceeds 64 inches (1626 mm). In solid grouted masonry, cleanouts shall be spaced horizontally a maximum of 32 in. (813 mm) on center. The cleanouts shall be sealed before grouting and after inspection.

R606.3.4.3 Construction. Requirements for grouted masonry construction shall be as follows:

1. Masonry shall be built to preserve the unobstructed vertical continuity of the cells or spaces to be filled. In partially grouted construction, cross webs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.
2. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.
3. Cells containing reinforcement shall be filled solidly with grout.
4. The thickness of grout or mortar between masonry units and reinforcement shall not be less than 1/4 inch (7 mm), except that 1/4-inch (7 mm) bars may be laid in horizontal mortar joints at least 1/2 inch (13 mm) thick, and steel wire reinforcement may be laid in horizontal mortar joints at least twice the thickness of the wire diameter.

~~R609.2~~ R606.3.5 Grouted multiple-wythe masonry. Grouted multiple-wythe masonry shall conform to all the requirements specified in Section ~~R609.1~~ R606.3.4 and the requirements of this section.

~~R609.2.1~~ R606.3.5.1 Bonding of backup wythe. Where all interior vertical spaces are filled with grout in multiple-wythe construction, masonry headers shall not be permitted. Metal wall ties shall be used in accordance with Section ~~R608.1.2~~ R606.13.2 to prevent spreading of the wythes and to maintain the vertical alignment of the wall. Wall ties shall be installed in accordance with Section ~~R608.1.2~~ R606.13.2 when the backup wythe in multiple-wythe construction is fully grouted.

~~R609.2.3~~ R606.3.5.2 Grout barriers. Vertical grout barriers or dams shall be built of *solid masonry* across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall not be more than 25 feet (7620 mm) apart. The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.

~~R608.2~~ R606.3.6 Masonry bonding pattern. Masonry laid in running and stack bond shall conform to Sections ~~R608.2.1 and R608.2.2~~ R606.3.6.1 and R606.3.6.2.

~~R608.2.1~~ R606.3.6.1 Masonry laid in running bond. In each wythe of masonry laid in running bond, head joints in successive courses shall be offset by not less than one-fourth the unit length, or the masonry walls shall be reinforced longitudinally as required in Section ~~R608.2.2~~ R606.3.6.2.

~~R608.2.2~~ R606.3.6.2 Masonry laid in stack bond. Where unit masonry is laid with less head joint offset than in Section ~~R608.2.1~~ R606.3.6.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart, shall be 0.0007 times the vertical cross-sectional area of the wall.

~~R606.2~~ R606.4 Thickness of masonry. The nominal thickness of masonry walls shall conform to the requirements of Sections ~~R606.2.1~~ R606.4.1 through ~~R606.2.4~~ R606.4.4.

~~R606.2.1~~ R606.4.1 Minimum thickness. The minimum thickness of masonry bearing walls more than one *story* high shall be 8 inches (203 mm). *Solid masonry* walls of one-story *dwellings* and garages shall not be less than 6 inches (152 mm) in thickness when not greater than 9 feet (2743 mm) in height, provided that when gable construction is used, an additional 6 feet (1829 mm) is permitted to the peak of the gable. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals as required by Section ~~R606.9~~ R606.6.4.

~~R606.2.2~~ R606.4.2 Rubble stone masonry wall. The minimum thickness of rough, random or coursed rubble stone masonry walls shall be 16 inches (406 mm).

~~R606.2.3~~ R606.4.3 Change in thickness. Where walls of masonry of hollow units or masonry-bonded hollow walls are decreased in thickness, a course of *solid masonry* or masonry units filled with mortar or grout shall be constructed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

~~R606.2.4~~ R606.4.4 Parapet walls. Unreinforced *solid masonry* parapet walls shall not be less than 8 inches (203 mm) thick and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than 8 inches (203 mm) thick, and their height shall not exceed three times their thickness. Masonry parapet walls in areas subject to wind loads of 30 pounds per square foot (1.44 kPa) located in Seismic Design Category D_0, D_1 or D_2, or on townhouses in Seismic Design Category C shall be reinforced in accordance with Section R606.12.

~~R606.3~~ R606.5 Corbeled masonry. Corbeled masonry shall be in accordance with Sections ~~R606.3.1~~ R606.5.1 through ~~R606.3.3~~ R606.5.3.

~~R606.3.1~~ R606.5.1 Units. *Solid masonry* units or masonry units filled with mortar or grout shall be used for corbeling.

~~R606.3.2~~ R606.5.2 Corbel projection. The maximum projection of one unit shall not exceed one-half the height of the unit or one-third the thickness at right angles to the wall. The maximum corbeled projection beyond the face of the wall shall not exceed:

1. One-half of the wall thickness for multi-wythe walls bonded by mortar or grout and wall ties or masonry headers, or
2. One-half the wythe thickness for single wythe walls, masonry-bonded hollow walls, multiwythe walls with open collar joints and veneer walls.

~~R606.3.3~~ R606.5.3 Corbeled masonry supporting floor or roof-framing members. When corbeled masonry is used to support floor or roof-framing members, the top course of the corbel shall be a header course or the top course bed joint shall have ties to the vertical wall.

~~R606.4~~ R606.6 Support conditions. Bearing and support conditions shall be in accordance with Sections ~~R606.4.1 and R606.4.2~~ R606.6.1 through R606.6.4.

~~R606.4.1~~ R606.6.1 Bearing on support. Each masonry wythe shall be supported by at least two-thirds of the wythe thickness.

~~R606.4.2~~ R606.6.2 Support at foundation. Cavity wall or masonry veneer construction ~~may~~ shall be permitted to be supported on an 8-inch (203 mm) foundation wall, provided the 8-inch (203 mm) wall is corbeled to the width of the wall system above with masonry constructed of *solid masonry* units or masonry units filled with mortar or grout. The total horizontal projection of the corbel shall not exceed 2 inches (51 mm) with individual corbels projecting not more than one-third the thickness of the unit or one-half the height of the unit. The hollow space behind the corbeled masonry shall be filled with mortar or grout.

~~R606.14~~ R606.6.3 Beam supports. Beams, girders or other concentrated loads supported by a wall or column shall have a bearing of at least 3 inches (76 mm) in length measured parallel to the beam upon *solid masonry* not less than 4 inches (102 mm) in thickness, or upon a metal bearing plate of adequate design and dimensions to distribute the load safely, or upon a continuous reinforced masonry member projecting not less than 4 inches (102 mm) from the face of the wall.

~~R606.14.1~~ R606.6.3.1 Joist bearing. Joists shall have a bearing of not less than 11/2 inches (38 mm), except as provided in Section ~~R606.14~~ R606.6.3, and shall be supported in accordance with Figure R606.11(1).

~~R606.9~~ R606.6.4 Lateral support. Masonry walls shall be laterally supported in either the horizontal or the vertical direction. The maximum spacing between lateral supports shall not exceed the distances in Table ~~R606.9~~ R606.6.4. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members when the limiting distance is taken horizontally, or by floors or roofs when the limiting distance is taken vertically.

TABLE ~~R606.9~~ R606.6.4
SPACING OF LATERAL SUPPORT FOR MASONRY WALLS

(Portions of Table not shown remain unchanged)

a. Except for cavity walls and cantilevered walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height to nominal thickness shall not exceed 6 for solid masonry, or 4 for hollow masonry. For parapets, see Section ~~R606.2.4~~ R606.4.4.

~~R606.9.1~~ R606.6.4.1 Horizontal lateral support. Lateral support in the horizontal direction provided by intersecting masonry walls shall be provided by one of the methods in Section ~~R606.9.1.1~~ R606.6.4.1.1 or Section ~~R606.9.1.2~~ R606.6.4.1.2.

~~R606.9.1.1~~ R606.6.4.1.1 Bonding pattern. Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 inches (76 mm) on the unit below.

~~R606.9.1.2~~ R606.6.4.1.2 Metal reinforcement. Interior nonloadbearing walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of at least 9 gage [0.148 inch (4mm)], or 1/4-inch (6 mm) galvanized mesh hardware cloth. Intersecting masonry walls, other than interior nonloadbearing walls, shall be anchored at vertical intervals of not more than 8 inches (203 mm) with joint reinforcement of at least 9 gage and shall extend at least 30 inches (762 mm) in each direction at the intersection. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by this section.

~~R606.9.2~~ R606.6.4.2 Vertical lateral support. Vertical lateral support of masonry walls in Seismic Design Category A, B or C shall be provided in accordance with one of the methods in Section ~~R606.9.2.1~~ R606.6.4.2.1 or Section ~~R606.9.2.2~~ R606.6.4.2.2.

~~R606.9.2.1~~ R606.6.4.2.1 Roof structures. Masonry walls shall be anchored to roof structures with metal strap anchors spaced in accordance with the manufacturer's instructions, 1/2-inch (13 mm) bolts spaced not more than 6 feet (1829 mm) on center, or other *approved* anchors. Anchors shall be embedded at least 16 inches (406 mm) into the masonry, or be hooked or welded to bond beam reinforcement placed not less than 6 inches (152 mm) from the top of the wall.

R606.6.4.2.2 ~~R606.9.2.2~~ Floor diaphragms. Masonry walls shall be anchored to floor *diaphragm* framing by metal strap anchors spaced in accordance with the manufacturer's instructions, 1/2-inch-diameter (13 mm) bolts spaced at intervals not to exceed 6 feet (1829 mm) and installed as shown in Figure R606.11(1), or by other *approved* methods.

R606.7 ~~R606.6~~ Piers. The unsupported height of masonry piers shall not exceed ten times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with ~~concrete~~ grout or Type M or S mortar, except that unfilled hollow piers may be used if their unsupported height is not more than four times their least dimension. Where hollow masonry units are solidly filled with ~~concrete~~ grout or Type M, S or N mortar, the allowable compressive stress shall be permitted to be increased as provided in Table ~~R606.5~~ R606.9.

~~R606.6.1~~ R606.7.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of *solid masonry* or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout.

~~R606.7~~ R606.8 Chases. Chases and recesses in masonry walls shall not be deeper than one-third the wall thickness, and the maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm), and shall have at least 8 inches (203 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings. Chases and recesses in masonry walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on noncombustible lintels.

~~R606.5~~ R606.9 Allowable stresses. Allowable compressive stresses in masonry shall not exceed the values prescribed in Table ~~R606.5~~ R606.9. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

~~R606.5.1~~ R606.9.1 Combined units. In walls or other structural members composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the member is composed. The net thickness of any facing unit that is used to resist stress shall not be less than 1.5 inches (38 mm).

TABLE ~~R606.5~~ R606.9
ALLOWABLE COMPRESSIVE STRESSES FOR EMPIRICAL DESIGN OF MASONRY

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT, GROSS AREA	ALLOWABLE COMPRESSIVE STRESSES[a] GROSS CROSS-SECTIONAL AREA[b]	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000 + psi	350	300
4,500 psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Grouted[c] masonry, of clay or shale; sand-lime or concrete:		
4,500 + psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Solid masonry of solid concrete masonry units:		
3,000 + psi	225	200
2,000 psi	160	140
1,200 psi	115	100
Masonry of hollow load-bearing units:		
2,000 + psi	140	120
1,500 psi	115	100
1,000 psi	75	70
700 psi	60	55
Hollow walls (cavity or masonry bonded[d]) solid units:		
2,500 + psi	160	140
1,500 psi	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320
Rubble stone masonry:		
Coarse, rough or random	120	100

For SI: 1 pound per square inch = 6.895 kPa.

a. Linear interpolation shall be used for determining allowable stresses for masonry units having compressive strengths that are intermediate between those given in the table.

b. Gross cross-sectional area shall be calculated on the actual rather than nominal dimensions.

c. See Section ~~R608~~ R606.13.

d. Where floor and roof loads are carried upon one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as cavity walls unless the collar joints are filled with mortar or grout.

R606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure R606.11(1), R606.11(2) or R606.11(3). Footings ~~may~~ shall be permitted to be considered as points of lateral support.

R606.12 Seismic requirements. The seismic requirements of this section shall apply to the design of masonry and the construction of masonry building elements located in Seismic Design Category D0, D1 or D2. Townhouses in Seismic Design Category C shall comply with the requirements of Section R606.12.2. These requirements shall not apply to glass unit masonry conforming to Section R610 ~~or~~ anchored masonry veneer conforming to Section R703.7, or adhered masonry veneer conforming to Section R703.12..

R606.12.3 Seismic Design Category D_0 or D_1. Structures in Seismic Design Category D_0 or D_1 shall comply with the requirements of Seismic Design Category C and the additional requirements of this section. AAC masonry shall not be used for the design of masonry elements that are part of the lateral force-resisting system.

~~SECTION R608~~
~~MULTIPLE-WYTHE MASONRY~~

~~**R608.1 General.**~~ **R606.13 Multiple-Wythe Masonry.** The facing and backing of multiple-wythe masonry walls shall be bonded in accordance with Section ~~R608.1.1, R608.1.2 or R608.1.3~~ R606.13.1, R606.13.2 or R606.13.3. In cavity walls, neither the facing nor the backing shall be less than 3 inches (76 mm) nominal in thickness and the cavity shall not be more than 4 inches (102 mm) nominal in width. The backing shall be at least as thick as the facing.

> **Exception:** Cavities shall be permitted to exceed the 4-inch (102 mm) nominal dimension provided tie size and tie spacing have been established by calculation.

~~**R608.1.1**~~ **R606.13.1 Bonding with masonry headers.** Bonding with solid or hollow masonry headers shall comply with Sections ~~R608.1.1.1 and R608.1.1.2~~ R606.13.1.1 and R606.13.1.2.

~~**R608.1.1.1**~~ **R606.13.1.1 Solid units.** Where the facing and backing (adjacent wythes) of *solid masonry* construction are bonded by means of masonry headers, no less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches (76 mm) into the backing. The distance between adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 3 inches (76 mm), or headers from opposite sides shall be covered with another header course overlapping the header below at least 3 inches (76 mm).

~~**R608.1.1.2**~~ **R606.13.1.2 Hollow units.** Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping at least 3 inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are at least 50 percent thicker than the units below.

~~**R608.1.2**~~ **R606.13.2 Bonding with wall ties or joint reinforcement.** Bonding with wall ties or joint reinforcement shall comply with Sections R606.13.2.1 ~~R608.1.2.1~~ through ~~R608.1.2.3~~ R606.13.2.3.

~~**R608.1.2.1**~~ **R606.13.2.1 Bonding with wall ties.** Bonding with wall ties, except as required by Section R610, where the facing and backing (adjacent wythes) of masonry walls are bonded with 3/16-inch-diameter (5 mm) wall ties embedded in the horizontal mortar joints, there shall be at least one metal tie for each 4.5 square feet (0.418 m2) of wall area. Ties in alternate courses shall be staggered. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls, the ends of ties shall be bent to 90- degree (0.79 rad) angles to provide hooks no less than 2 inches (51 mm) long. Additional bonding ties shall be provided at all openings, spaced not more than 3 feet (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

~~**R608.1.2.2**~~ **R606.13.2.2 Bonding with adjustable wall ties.** Where the facing and backing (adjacent wythes) of masonry are bonded with adjustable wall ties, there shall be at least one tie for each 2.67 square feet (0.248 m2) of wall area. Neither the vertical nor the horizontal spacing of the adjustable wall ties shall exceed 24 inches (610 mm). The maximum vertical offset of bed joints from one wythe to the other shall be 1.25 inches (32 mm). The maximum clearance between connecting parts of the ties shall be 1/16 inch (2 mm). When pintle legs are used, ties shall have at least two 3/16-inch-diameter (5 mm) legs.

~~**R608.1.2.3**~~ **R606.13.2.3 Bonding with prefabricated joint reinforcement.** Where the facing and backing (adjacent wythes) of masonry are bonded with prefabricated joint reinforcement, there shall be at least one cross wire serving as a tie for each 2.67 square feet (0.248 m2) of wall area. The vertical spacing of the joint reinforcement shall not exceed 16 inches (406 mm). Cross wires on prefabricated joint reinforcement shall not be smaller than No. 9 gage. The longitudinal wires shall be embedded in the mortar.

~~**R608.1.3**~~ **R606.13.3 Bonding with natural or cast stone.** Bonding with natural and cast stone shall conform to Sections ~~R608.1.3.1 and R608.1.3.2~~ R606.13.3.1 and R606.13.3.2.

~~**R608.1.3.1**~~ **R606.13.3.1 Ashlar masonry.** In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10 percent of the wall area. Such bonder units shall extend not less than 4 inches (102 mm) into the backing wall.

~~**R608.1.3.2**~~ **R606.13.3.2 Rubble stone masonry.** Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of 3 feet (914 mm) vertically and 3 feet (914 mm) horizontally, and if the masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each 6 square feet (0.557 m2) of wall surface on both sides.

R606.14 Anchored and adhered masonry veneer.

R606.14.1 Anchored veneer. Anchored masonry veneer installed over a backing of wood or cold-formed steel shall meet the requirements of Section R703.7.

R606.14.2 Adhered veneer. Adhered masonry veneer shall be installed in accordance with the requirements of Section R703.12.

~~**R606.8 Stack bond.** In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcement consisting of not less than two continuous wires each with a minimum aggregate cross-sectional area of 0.017 square inch (11 mm2) shall be provided in horizontal bed joints spaced not more than 16 inches (406 mm) on center vertically.~~

~~**R606.15 Metal accessories.** Joint reinforcement, anchors, ties and wire fabric shall conform to the following: ASTM A 82 for wire anchors and ties; ASTM A 36 for plate, headed and bent-bar anchors; ASTM A 510 for corrugated sheet metal anchors and ties; ASTM A 951 for joint reinforcement; ASTM B 227 for copper-clad steel wire ties; or ASTM A 167 for stainless steel hardware.~~

~~**SECTION R607**~~
~~**UNIT MASONRY**~~

~~**R607.1 Mortar.** Mortar for use in masonry construction shall comply with ASTM C 270. The type of mortar shall be in accordance with Sections R607.1.1, R607.1.2 and R607.1.3 and shall meet the proportion specifications of Table R607.1 or the property specifications of ASTM C 270.~~

~~**R607.2 Placing mortar and masonry units.**~~

~~SECTION R609~~
~~GROUTED MASONRY~~

~~**R609.1 General.** Grouted multiple-wythe masonry is a form of construction in which the space between the wythes is solidly filled with grout. It is not necessary for the cores of masonry units to be filled with grout. Grouted hollow unit masonry is a form of construction in which certain cells of hollow units are continuously filled with grout.~~

~~**R609.1.2 Grouting requirements.** Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table R609.1.2. If the work is stopped for one hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout 1 inch (25 mm) below the top.~~

~~**R609.1.3 Grout space (cleaning).** Provision shall be made for cleaning grout space. Mortar projections that project more than 1/2 inch (13 mm) into grout space and any other foreign matter shall be removed from grout space prior to inspection and grouting.~~

~~**R609.1.4 Grout placement.** Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an *approved* alternate method and shall be placed before any initial set occurs and in no case more than 11/2 hours after water has been added. Grouting shall be done in a continuous pour, in lifts not exceeding 5 feet (1524 mm). It shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost.~~

~~**R609.1.4.1 Grout pumped through aluminum pipes.** Grout shall not be pumped through aluminum pipes.~~

~~**R609.1.5 Cleanouts.** Where required by the *building official*, cleanouts shall be provided as specified in this section. The cleanouts shall be sealed before grouting and after inspection.~~

~~**R609.1.5.1 Grouted multiple-wythe masonry.** Cleanouts shall be provided at the bottom course of the exterior wythe at each pour of grout where such pour exceeds 5 feet (1524 mm) in height.~~

~~**R609.1.5.2 Grouted hollow unit masonry.** Cleanouts shall be provided at the bottom course of each cell to be grouted at each pour of grout, where such pour exceeds 4 feet (1219 mm) in height.~~

~~**R609.2.2 Grout spaces.** Fine grout shall be used when interior vertical space to receive grout does not exceed 2 inches (51 mm) in thickness. Interior vertical spaces exceeding 2 inches (51 mm) in thickness shall use coarse or fine grout.~~

~~**R609.3 Reinforced grouted multiple-wythe masonry.** Reinforced grouted multiple-wythe masonry shall conform to all the requirements specified in Sections R609.1 and R609.2 and the requirements of this section.~~

~~**R609.3.1 Construction.** The thickness of grout or mortar between masonry units and reinforcement shall not be less than 1/4 inch (7 mm), except that 1/4-inch (7 mm) bars may be laid in horizontal mortar joints at least 1/2 inch (13 mm) thick, and steel wire reinforcement may be laid in horizontal mortar joints at least twice the thickness of the wire diameter.~~

~~**R609.4 Reinforced hollow unit masonry.** Reinforced hollow unit masonry shall conform to all the requirements of Section R609.1 and the requirements of this section.~~

~~**R609.4.1 Construction.** Requirements for construction shall be as follows:~~

~~1. Reinforced hollow-unit masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and cross webs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Bond shall be provided by lapping units in successive vertical courses.~~
~~2. Cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell of dimensions prescribed in Table R609.1.2.~~
~~3. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.~~
~~4. Cells containing reinforcement shall be filled solidly with grout. Grout shall be poured in lifts of 8-foot (2438 mm) maximum height. When a total grout pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 5 feet (1524 mm) and special inspection during grouting shall be required.~~
~~5. Horizontal steel shall be fully embedded by grout in an uninterrupted pour.~~

Add new standards to Chapter 44 as follows:

ASTM

C56 Standard Specification for Structural Clay Nonloadbearing Tile
C126 Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
C212 Standard Specification for Structural Clay Facing Tile
C503 Standard Specification for Marble Dimension Stone
C568 Standard Specification for Limestone Dimension Stone
C615 Standard Specification for Granite Dimension Stone
C629 Standard Specification for Slate Dimension Stone
C744 Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
C946 Standard Practice for Construction of Dry-Stacked, Surface-Bonded Walls
C1088 Standard Specification for Thin Veneer Brick Units Made From Clay or Shale
C1364 Standard Specification for Architectural Cast Stone
C1386 Standard Specification for Precast Autoclaved Aerated Concrete (AAC) Wall Construction Units
C1405 Standard Specification for Glazed Brick (Single Fired, Brick Units)
C1634 Standard Specification for Concrete Facing Brick

ANSI

A118.4 American National Standard Specifications for Latex-Portland Cement Mortar

Reason: This change proposal is largely a clean-up and consolidation of the masonry design and construction requirements currently scattered throughout Sections R606, R607, R608, and R609. The provisions of these four sections have evolved over time somewhat autonomously resulting in conflicts and disconnects. For example, mortar requirements for masonry construction are covered in Section R607; however these requirements are not cited by Sections R606, R608, or R609.

Given the substantial reorganization, there are some technical differences proposed here compared to the existing requirements of Sections R606, R607, R608, and R609:

- A new Section R602.2 has been added to define the minimum requirements for masonry materials. While the IRC covers material requirements for mortar and grout, masonry unit requirements are not explicitly defined and as such are proposed to be added. Where the IRC does not define masonry material requirements, the provisions of the IBC are proposed.
- There are several conflicts in the existing grouting requirements. Grout pour height triggering cleanouts vary depending upon whether the masonry construction is multi-wythe, single wythe, or reinforced. Here, the grout lift requirements triggering cleanouts is changed to 64 inches for all masonry construction to be consistent with current IBC requirements. Similarly, grout lift requirements triggering special inspection are increased from 60 to 64 inches for consistency.
- Some non-mandatory language is revised.
- Section R606.12.3 introduces a limit on the use of AAC masonry in shear walls assigned to SDC D consistent with existing IBC limits.
- Redundant provisions are removed. For example, Section R606.8, which addresses minimum horizontal reinforcement requirements for masonry laid in stack bond, is already covered by Section R606.3.6.2. Likewise, grout space requirements per Section R609.2.2 are covered by the grout space requirements of Table R606.3.4.1.

- A new Section R606.14 is added that provides a pointer to the anchored and adhered veneer provisions of Chapter 7.

Cost Impact: This code change will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, ASTM C 56, ASTM C 126, ASTM C212, ASTM C 503, ASTM C 568, ASTM C 615, ASTM C 616, ASTM C 629, ASTM C 744, ASTM C 946, ASTM C 1088, ASTM C1364, ASTM C1386, ASTM C 1405, ASTM C 1634 and ANSI A 118.4 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB332-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB333 – 13
Figure R606.11(1)

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

LEDGER BOLT SIZE AND SPACING

JOIST SPAN	BOLT SIZE AND SPACING	
	ROOF	FLOOR
10 FT.	1/2 AT 2 FT. 0~~6~~ IN. 7/8 AT 3 FT. 4~~6~~ IN.	1/2 AT 2 FT. 0 IN. 7/8 AT 2 FT. 8~~9~~ IN.
10-15 FT.	1/2 AT 1 FT. 4~~9~~ IN. 7/8 AT 2 FT. 0~~6~~ IN.	1/2 AT 1 FT. 4 IN. 7/8 AT 2 FT. 0 IN.
15-20 FT.	1/2 AT 0~~1~~ FT. 8~~3~~ IN. 7/8 AT 2 FT. 0 IN.	1/2 AT 0~~1~~ FT. 8~~0~~ IN. 7/8 AT 1 FT. 4~~6~~ IN.

FIGURE R606.11(1)
ANCHORAGE REQUIREMENTS FOR MASONRY WALLS LOCATED IN SEISMIC DESIGN CATEGORY a, B OR c AND WHERE WIND LOADS ARE LESS THAN 30 PSF

(Portions of Figure not shown remain unchanged)

Reason: The ledger bolt spacing options currently shown in Figure R606.11(1) have caused confusion because the spacings are not based on a standard masonry module. This change proposal conservatively reduces the anchor spacing to correspond to an 8 inch module.

Cost Impact: This code change will increase the cost of construction.

RB333-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB334 – 13

R611.2, R611.6.2, Table R611.6(1), Table R611.6(2), Table R611.6(3), Table R611.6(4), R611.7.1.1, Table R611.7(1A), Table R611.7(1B), Table R611.7(1C), Figure R611.9(1), Table R611.9(1), Figure R611.9(2), Table R611.9(2), Figure R611.9(3), Table R611.9(3), Figure R611.9(4), Table R611.9(4), Figure R611.9(5), Table R611.9(5), Figure R611.9(6), Table R611.9(6), Figure R611.9(7), Table R611.9(7), Figure R611.9(8), Table R611.9(8), Figure R611.9(9), Table R611.9(9), Figure R611.9(10), Table R611.9(10), Figure R611.9(11), Table R611.9(11), Figure R611.9(12), Table R611.9(12), R611.9.2, R611.9.3, R611.10

Proponent: Stephen S. Szoke, P.E., Portland Cement Association

Revise as follows:

R611.2 Applicability limits. The provisions of this section shall apply to the construction of exterior concrete walls for buildings not greater than 60 feet (18 288 mm) in plan dimensions, floors with clear spans not greater than 32 feet (9754 mm) and roofs with clear spans not greater than 40 feet (12 192 mm). Buildings shall not exceed 35 feet (10 668 mm) in mean roof height or two stories in height above-grade. Floor/ceiling dead loads shall not exceed 10 pounds per square foot (479 Pa), roof/ceiling dead loads shall not exceed 15 pounds per square foot (718 Pa) and *attic* live loads shall not exceed 20 pounds per square foot (958 Pa). Roof overhangs shall not exceed 2 feet (610 mm) of horizontal projection beyond the exterior wall and the dead load of the overhangs shall not exceed 8 pounds per square foot (383 Pa).

Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of ~~130 miles per hour (58 m/s)~~160 miles per hour (72 m/s) Exposure B, ~~110 miles per hour (49 m/s)~~136 miles per hour (61 m/s) Exposure C and ~~100 miles per hour (45 m/s)~~125 miles per hour (56 m/s) Exposure D. Walls constructed in accordance with the provisions of this section shall be limited to detached one- and two-family *dwellings* and townhouses assigned to Seismic Design Category A or B, and detached one- and two-family *dwellings* assigned to Seismic Design Category C.

Buildings that are not within the scope of this section shall be designed in accordance with PCA 100 or ACI 318.

R611.6.2 Wall reinforcement for wind. Vertical wall reinforcement for resistance to out-of-plane wind forces shall be determined from Table R611.6(1), R611.6(2), R611.6(3) or R611.6(4). For the design of non-loadbearing walls, in Tables R611.6(1), R611.6(2) and R611.6(3) use the appropriate column labeled "top." Also, see Sections R611.7.2.2.2 and R611.7.2.2.3. There shall be a vertical bar at all corners of exterior walls. Unless more horizontal reinforcement is required by Section R611.7.2.2.1, the minimum horizontal reinforcement shall be four No. 4 bars [Grade 40 (280 MPa)] placed as follows: top bar within 12 inches (305 mm) of the top of the wall, bottom bar within 12 inches (305 mm) of the finish floor, and one bar each at approximately one-third and two-thirds of the wall height.

~~TABLE R611.6(1)~~
~~MINIMUM VERTICAL REINFORCEMENT FOR FLAT ABOVE-GRADE WALLS~~~~[a, b, c, d, e]~~

~~MAXIMUM WIND SPEED (mph)~~			~~MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)~~	~~MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)~~~~[f, g]~~							
				~~Nominal~~~~[h]~~ ~~wall thickness (inches)~~							
~~Exposure Category~~				~~4~~		~~6~~		~~8~~		~~10~~	
~~B~~	~~C~~	~~D~~		~~Top~~~~[i]~~	~~Side~~~~[i]~~	~~Top~~~~[i]~~	~~Side~~~~[i]~~	~~Top~~~~[i]~~	~~Side~~~~[i]~~	~~Top~~~~[i]~~	~~Side~~~~[i]~~

			~~8~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~85~~	—	—	~~9~~	~~4@48~~	~~4@43~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@47~~	~~4@36~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~8~~	~~4@48~~	~~4@47~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~90~~	—	—	~~9~~	~~4@48~~	~~4@39~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@42~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~8~~	~~4@48~~	~~4@40~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~100~~	~~85~~	—	~~9~~	~~4@42~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@34~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~8~~	~~4@44~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~110~~	~~90~~	~~85~~	~~9~~	~~4@34~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@34~~	~~4@31~~	~~4@48~~	~~4@37~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~8~~	~~4@36~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~120~~	~~100~~	~~90~~	~~9~~	~~4@34~~	~~4@32~~	~~4@48~~	~~4@38~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@30~~	~~4@27~~	~~4@48~~	~~5@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~8~~	~~4@34~~	~~4@34~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
~~130~~	~~110~~	~~100~~	~~9~~	~~4@32~~	~~4@28~~	~~4@48~~	~~4@33~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~
			~~10~~	~~4@26~~	~~4@23~~	~~4@48~~	~~5@43~~	~~4@48~~	~~4@48~~	~~4@48~~	~~4@48~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 1.895 kPa, 1 square foot = 0.0929 m²~~.

~~a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, and topographic factor, K_{zt}, and importance factor, *I*, equal to 1.0.~~

~~b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.~~

~~c. See Section R611.6.5 for location of reinforcement in wall.~~

~~d. Deflection criterion is *L*/240, where *L* is the unsupported height of the wall in inches.~~

~~e. Interpolation is not permitted.~~

~~f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.~~

~~g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).~~

~~h. See Table R611.3 for tolerances on nominal thicknesses.~~

~~i. Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, use of the top bearing condition is permitted.~~

TABLE R611.6(1)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT ABOVE-GRADE WALLS[a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]							
				Nominal[h] wall thickness (inches)							
Exposure Category				4		6		8		10	
B	C	D		Top[i]	Side[i]	Top[i]	Side[i]	Top[i]	Side[i]	Top[i]	Side[i]

115			8	4@48	4@48	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@39	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@41	4@34	4@48	4@48	4@48	4@48	4@48	4@48
120			8	4@48	4@43	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@36	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
130	110		8	4@48	4@38	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@39	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
140	119	110	8	4@43	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@31	4@48	4@48	4@48	4@48	4@48	4@48
150	127	117	8	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@33	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@31	4@27	4@48	4@48	4@48	4@48	4@48	4@48
160	136	125	8	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@29	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@27	4@24	4@48	4@48	4@48	4@48	4@48	4@48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 1.895 kPa, 1 square foot = 0.0929 m^2.

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II.

b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c. See Section R611.6.5 for location of reinforcement in wall.

d. Deflection criterion is *L*/240, where *L* is the unsupported height of the wall in inches.

e. Interpolation is not permitted.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).

h. See Table R611.3 for tolerances on nominal thicknesses.

i. "Top" means gravity load from roof and/or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonloadbearing walls and where floor framing members span parallel to the wall, use of the "top" bearing condition is permitted.

~~TABLE R611.6(2)~~
~~MINIMUM VERTICAL REINFORCEMENT FOR WAFFLE-GRID ABOVE-GRADE WALLS~~[a, b, c, d, e]

~~MAXIMUM WIND SPEED (mph)~~			~~MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)~~	~~MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)~~[f, g]			
				~~Nominal~~[h] ~~wall thickness (inches)~~			
~~Exposure Category~~				~~6~~		~~8~~	
~~B~~	~~C~~	~~D~~		~~Top~~[i]	~~Side~~[i]	~~Top~~[i]	~~Side~~[i]
~~85~~	~~—~~	~~—~~	~~8~~	~~4@48~~	~~4@36, 5@48~~	~~4@48~~	~~4@48~~
			~~9~~	~~4@48~~	~~4@30, 5@47~~	~~4@48~~	~~4@45~~
			~~10~~	~~4@48~~	~~4@26, 5@40~~	~~4@48~~	~~4@39~~

~~90~~	~~—~~	~~—~~	~~8~~	~~4@48~~	~~4@33, 5@48~~	~~4@48~~	~~4@48~~
			~~9~~	~~4@48~~	~~4@28, 5@43~~	~~4@48~~	~~4@42~~
			~~10~~	~~4@31, 5@48~~	~~4@24, 5@37~~	~~4@48~~	~~4@36~~
~~100~~	~~85~~	~~—~~	~~8~~	~~4@48~~	~~4@28, 5@44~~	~~4@48~~	~~4@43~~
			~~9~~	~~4@31, 5@48~~	~~4@24, 5@37~~	~~4@48~~	~~4@36~~
			~~10~~	~~4@25, 5@39~~	~~4@24, 5@37~~	~~4@48~~	~~4@31, 5@48~~
~~110~~	~~90~~	~~85~~	~~8~~	~~4@33, 5@48~~	~~4@25, 5@38~~	~~4@48~~	~~4@38~~
			~~9~~	~~4@26, 5@40~~	~~4@24, 5@37~~	~~4@48~~	~~4@31, 5@48~~
			~~10~~	~~4@24, 5@37~~	~~4@23, 5@35~~	~~4@48~~	~~4@27, 5@41~~
~~120~~	~~100~~	~~90~~	~~8~~	~~4@27, 5@42~~	~~4@24, 5@37~~	~~4@48~~	~~4@33, 5@48~~
			~~9~~	~~4@24, 5@37~~	~~4@23, 5@36~~	~~4@48~~	~~4@27, 5@43~~
			~~10~~	~~4@23, 5@35~~	~~4@19, 5@30~~	~~4@48~~	~~4@23, 5@36~~
~~130~~	~~110~~	~~100~~	~~8~~	~~4@24, 5@37~~	~~4@24, 5@37~~	~~4@48~~	~~4@29, 5@45~~
			~~9~~	~~4@24, 5@37~~	~~4@20, 5@32~~	~~4@48~~	~~4@24, 5@37~~
			~~10~~	~~4@19, 5@30~~	~~4@17, 5@26~~	~~4@23, 5@36~~	~~4@20, 5@31~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m^2.~~

~~a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, and topographic factor, K_{zt}, and importance factor, *I*, equal to 1.0.~~

~~b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.~~

~~c. See Section R611.6.5 for location of reinforcement in wall.~~

~~d. Deflection criterion is *L*/240, where *L* is the unsupported height of the wall in inches.~~

~~e. Interpolation is not permitted.~~

~~f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.~~

~~g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).~~

~~h. See Table R611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.~~

~~i. Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, the top bearing condition is permitted to be used.~~

TABLE R611.6(2)
MINIMUM VERTICAL REINFORCEMENT FOR WAFFLE-GRID ABOVE-GRADE WALLS[a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]			
Exposure Category				Nominal[h] wall thickness (inches)			
				6		8	
B	C	D		Top[i]	Side[i]	Top[i]	Side[i]
115			8	4@48	4@48	4@48	4@48
			9	4@48	5@43	4@48	4@48
			10	5@47	5@37	4@48	4@48

120			8	4@48	5@48	4@48	4@48
			9	4@48	5@40	4@48	4@48
			10	5@43	5@37	4@48	4@48
130	110		8	4@48	5@42	4@48	4@48
			9	5@45	5@37	4@48	4@48
			10	5@37	5@37	4@48	4@48
140	119	110	8	4@48	5@38	4@48	4@48
			9	5@39	5@37	4@48	4@48
			10	5@37	5@35	4@48	4@48
150	127	117	8	5@43	5@37	4@48	4@48
			9	5@37	5@37	4@48	4@48
			10	5@36	6@44	4@48	4@48
160	136	125	8	5@38	5@37	4@48	4@48
			9	5@37	6@47	4@48	4@48
			10	6@45	6@39	4@48	6@46

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m^2.

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt} equal to 1.0, and Risk Category II.

b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c. See Section R611.6.5 for location of reinforcement in wall.

d. Deflection criterion is L /240, where L is the unsupported height of the wall in inches.

e. Interpolation is not permitted.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).

h. See Table R611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.

i. "Top" means gravity load from roof and/or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For non-loadbearing walls and where floor framing members span parallel to the wall, the "top" bearing condition is permitted to be used.

~~TABLE R611.6(3)~~
~~MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH SCREEN-GRID ABOVE-GRADE WALLS~~[~~a, b, c, d, e~~]

~~MAXIMUM WIND SPEED (mph)~~			~~MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)~~	~~MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)~~[~~f, g~~]	
~~Exposure Category~~				~~Nominal~~[~~h~~] ~~wall thickness (inches)~~	
				~~6~~	
~~B~~	~~C~~	~~D~~		~~Top~~[~~i~~]	~~Side~~[~~i~~]
~~85~~	~~—~~	~~—~~	~~8~~	~~4@48~~	~~4@34, 5@48~~
			~~9~~	~~4@48~~	~~4@29, 5@45~~
			~~10~~	~~4@48~~	~~4@25, 5@39~~
~~90~~	~~—~~	~~—~~	~~8~~	~~4@48~~	~~4@31, 5@48~~

			~~9~~	~~4@48~~	~~4@27, 5@41~~
			~~10~~	~~4@30, 5@47~~	~~4@23, 5@35~~
~~100~~	~~85~~	~~—~~	~~8~~	~~4@48~~	~~4@27, 5@42~~
			~~9~~	~~4@30, 5@47~~	~~4@23, 5@35~~
			~~10~~	~~4@24, 5@38~~	~~4@22, 5@34~~
~~110~~	~~90~~	~~85~~	~~8~~	~~4@48~~	~~4@24, 5@37~~
			~~9~~	~~4@25, 5@38~~	~~4@22, 5@34~~
			~~10~~	~~4@22, 5@34~~	~~4@22, 5@34~~
~~120~~	~~100~~	~~90~~	~~8~~	~~4@26, 5@41~~	~~4@22, 5@34~~
			~~9~~	~~4@22, 5@34~~	~~4@22, 5@34~~
			~~10~~	~~4@22, 6@34~~	~~4@19, 5@26~~
~~130~~	~~110~~	~~100~~	~~8~~	~~4@22, 5@35~~	~~4@22, 5@34~~
			~~9~~	~~4@22, 5@34~~	~~4@20, 5@30~~
			~~10~~	~~4@19, 5@29~~	~~4@16, 5@25~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m²~~.

~~a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, and topographic factor, K_{zt}, and importance factor, *I*, equal to 1.0.~~

~~b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.~~

~~c. See Section R611.6.5 for location of reinforcement in wall.~~

~~d. Deflection criterion is *L*/240, where *L* is the unsupported height of the wall in inches.~~

~~e. Interpolation is not permitted.~~

~~f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.~~

~~g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).~~

~~h. See Table R611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.~~

~~i. Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, use of the top bearing condition is permitted.~~

TABLE R611.6(3)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH SCREEN-GRID ABOVE-GRADE WALLS[a, b, c, d, e]

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]	
				Nominal[h] wall thickness (inches)	
Exposure Category				6	
B	C	D		Top[i]	Side[i]
115			8	4@48	4@48
			9	4@48	5@41
			10	4@48	6@48

120			8	4@48	4@48
			9	4@48	5@38
			10	5@42	6@48
130	110		8	4@48	5@41
			9	5@44	6@48
			10	5@35	6@48
140	119	110	8	4@48	5@36
			9	5@38	6@48
			10	6@48	6@48
150	127	117	8	5@42	6@48
			9	6@48	6@48
			10	6@48	6@42
160	136	125	8	5@37	6@48
			9	6@48	6@45
			10	6@44	6@38

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m^2.

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II.

b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c. See Section R611.6.5 for location of reinforcement in wall.

d. Deflection criterion is L/240, where L is the unsupported height of the wall in inches.

e. Interpolation is not permitted.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).

h. See Table R611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.

i. "Top" means gravity load from roof and/or floor construction bears on top of wall. "Side" means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For non-loadbearing wall and where floor framing members span parallel to the wall, use of the "top" bearing condition is permitted.

~~TABLE R611.6(4)~~
~~MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID ABOVE-GRADE WALLS DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS~~[~~a, b, c, d, e, k, l~~]

~~MAXIMUM WIND SPEED (mph)~~			~~HEIGHT OF STEM WALL~~[~~h, i~~] ~~(feet)~~	~~MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)~~	~~MAXIMUM UNSUPPORTED HEIGHT OF ABOVE-GRADE WALL (feet)~~	~~MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)~~[~~f, g~~]						
~~Exposure Category~~						~~Wall type and nominal thickness~~[~~j~~] ~~(inches)~~						
						~~Flat~~				~~Waffle~~		~~Screen~~
~~B~~	~~C~~	~~D~~				~~4~~	~~6~~	~~8~~	~~10~~	~~6~~	~~8~~	~~6~~
~~85~~	—	—	~~3~~	~~30~~	~~8~~	~~4@33~~	~~4@39~~	~~4@48~~	~~4@48~~	~~4@24~~	~~4@28~~	~~4@22~~
					~~10~~	~~4@26~~	~~5@48~~	~~4@41~~	~~4@48~~	~~4@19~~	~~4@22~~	~~4@18~~
				~~60~~	~~10~~	~~4@21~~	~~5@40~~	~~5@48~~	~~4@44~~	~~4@16~~	~~4@19~~	~~4@15~~
			~~6~~	~~30~~	~~10~~	~~DR~~	~~5@22~~	~~6@35~~	~~6@43~~	~~DR~~	~~4@11~~	~~DR~~

				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@26~~	~~6@28~~	~~DR~~	~~DR~~	~~DR~~
~~90~~	~~—~~	~~—~~	~~3~~	~~30~~	~~8~~	~~4@30~~	~~4@36~~	~~4@48~~	~~4@48~~	~~4@22~~	~~4@26~~	~~4@21~~
					~~10~~	~~4@24~~	~~5@44~~	~~4@38~~	~~4@48~~	~~4@17~~	~~4@21~~	~~4@17~~
				~~60~~	~~10~~	~~4@20~~	~~5@37~~	~~4@48~~	~~4@41~~	~~4@15~~	~~4@18~~	~~4@14~~
			~~6~~	~~30~~	~~10~~	~~DR~~	~~5@21~~	~~6@35~~	~~6@41~~	~~DR~~	~~4@10~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@26~~	~~6@28~~	~~DR~~	~~DR~~	~~DR~~
~~100~~	~~85~~	~~—~~	~~3~~	~~30~~	~~8~~	~~4@26~~	~~5@48~~	~~4@42~~	~~4@48~~	~~4@19~~	~~4@23~~	~~4@18~~
					~~10~~	~~4@20~~	~~5@37~~	~~4@33~~	~~4@41~~	~~4@15~~	~~4@18~~	~~4@14~~
			~~6~~	~~60~~	~~10~~	~~4@17~~	~~5@34~~	~~5@44~~	~~4@36~~	~~4@13~~	~~4@17~~	~~4@12~~
				~~30~~	~~10~~	~~DR~~	~~5@20~~	~~6@35~~	~~6@38~~	~~DR~~	~~4@9~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@24~~	~~6@28~~	~~DR~~	~~DR~~	~~DR~~
~~110~~	~~90~~	~~85~~	~~3~~	~~30~~	~~8~~	~~4@22~~	~~5@42~~	~~4@37~~	~~4@46~~	~~4@16~~	~~4@20~~	~~4@16~~
					~~10~~	~~4@17~~	~~5@34~~	~~5@44~~	~~4@35~~	~~4@12~~	~~4@17~~	~~4@12~~
				~~60~~	~~10~~	~~4@15~~	~~5@34~~	~~5@39~~	~~5@48~~	~~4@11~~	~~4@17~~	~~4@11~~
			~~6~~	~~30~~	~~10~~	~~DR~~	~~5@18~~	~~6@35~~	~~6@35~~	~~DR~~	~~4@9~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@23~~	~~6@28~~	~~DR~~	~~DR~~	~~DR~~
~~120~~	~~100~~	~~90~~	~~3~~	~~30~~	~~8~~	~~4@19~~	~~5@37~~	~~5@48~~	~~4@40~~	~~4@14~~	~~4@17~~	~~4@14~~
					~~10~~	~~4@14~~	~~5@34~~	~~5@38~~	~~5@48~~	~~4@11~~	~~4@17~~	~~4@10~~
				~~60~~	~~10~~	~~4@13~~	~~5@33~~	~~6@48~~	~~5@43~~	~~4@10~~	~~4@16~~	~~4@9~~
			~~6~~	~~30~~	~~10~~	~~DR~~	~~5@16~~	~~6@33~~	~~6@32~~	~~DR~~	~~4@8~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@22~~	~~6@28~~	~~DR~~	~~DR~~	~~DR~~
~~130~~	~~110~~	~~100~~	~~3~~	~~30~~	~~8~~	~~4@17~~	~~5@34~~	~~5@44~~	~~4@36~~	~~4@12~~	~~4@17~~	~~4@10~~
					~~10~~	~~DR~~	~~5@32~~	~~6@47~~	~~5@42~~	~~4@9~~	~~4@15~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~5@29~~	~~6@43~~	~~5@39~~	~~DR~~	~~4@14~~	~~DR~~
			~~6~~	~~30~~	~~10~~	~~DR~~	~~5@15~~	~~6@30~~	~~6@29~~	~~DR~~	~~4@7~~	~~DR~~
				~~60~~	~~10~~	~~DR~~	~~DR~~	~~6@21~~	~~6@27~~	~~DR~~	~~DR~~	~~DR~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m~~^{2}~~.~~

~~a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, and topographic factor,~~ K_{zt}, ~~and importance factor, *I*, equal to 1.0.~~

~~b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.~~

~~c. See Section R611.6.5 for location of reinforcement in wall.~~

~~d. Deflection criterion is *L*/240, where *L* is the height of the wall in inches from the exterior finish ground level to the top of the above-grade wall.~~

~~e. Interpolation is not permitted. For intermediate values of basic wind speed, heights of stem wall and above-grade wall, and design lateral soil load, use next higher value.~~

~~f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.~~

~~g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. In waffle and screen-grid walls where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).~~

~~h. Height of stem wall is the distance from the exterior finish ground level to the top of the slab-on-ground.~~

~~i. Where the distance from the exterior finish ground level to the top of the slab-on-ground is equal to or greater than 4 feet, the stem wall shall be laterally supported at the top and bottom before backfilling. Where the wall is designed and constructed to be continuous with the above-grade wall, temporary supports bracing the top of the stem wall shall remain in place until the above-grade wall is laterally supported at the top by floor or roof construction.~~

~~j. See Table R611.3 for tolerances on nominal thicknesses, and minimum core dimensions and maximum spacing of horizontal and vertical cores for waffle- and screen-grid walls.~~

~~k. Tabulated values are applicable to construction where gravity loads bear on top of wall, and conditions where gravity loads from floor construction are transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. See Tables R611.6(1), R611.6(2) and R611.6(3).~~

~~l. DR indicates design required.~~

TABLE R611.6(4)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID ABOVE-GRADE WALLS DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS[a, b, c, d, e, k, l]

MAXIMUM WIND SPEED (mph)			HEIGHT OF STEM WALL[h, i] (feet)	MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)	MAXIMUM UNSUPPORTED HEIGHT OF ABOVE-GRADE WALL (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)[f, g]						
Exposure Category						Wall type and nominal thickness[j] (inches)						
						Flat				Waffle		Screen
B	C	D				4	6	8	10	6	8	6
115			3	30	8	4@30	4@48	4@48	4@48	4@22	4@26	4@21
					10	4@23	5@43	4@48	4@48	4@17	4@20	4@16
				60	10	4@19	5@37	4@48	4@48	4@14	4@17	4@14
			6	30	10	DR	5@21	6@35	4@48	DR	4@10	DR
				60	10	DR	5@12	6@25	6@28	DR	DR	DR
120			3	30	8	4@28	4@48	4@48	4@48	4@21	4@48	4@20
					10	4@22	5@41	4@48	4@48	4@16	4@19	4@15
				60	10	4@18	5@35	4@48	4@48	4@14	4@17	4@13
			6	30	10	DR	5@21	6@35	4@48	DR	4@10	DR
				60	10	DR	5@12	6@25	6@28	DR	DR	DR
130	110		3	30	8	4@25	4@48	4@48	4@48	4@18	4@22	4@18
					10	4@19	5@36	4@48	4@48	4@14	4@17	4@13
			6	60	10	4@16	5@34	4@48	4@48	4@12	4@17	4@12
				30	10	DR	5@19	6@35	4@48	DR	4@9	DR
				60	10	DR	5@12	6@24	6@28	DR	DR	DR
140	119	110	3	30	8	4@22	5@42	4@48	4@48	4@16	4@20	4@16
					10	4@17	5@34	4@48	4@48	4@21	4@17	4@12
				60	10	4@15	5@34	4@48	4@48	4@11	4@17	4@10
			6	30	10	DR	5@18	6@35	6@35	DR	4@48	DR
				60	10	DR	5@11	6@23	6@28	DR	DR	DR
150	127	117	3	30	8	4@20	5@37	4@48	4@48	4@15	4@18	4@14
					10	4@15	5@34	4@48	4@48	4@11	4@17	4@11
				60	10	4@13	5@34	4@48	4@48	4@10	4@16	4@9

			6	30	10	DR	5@17	6@33	6@32	DR	4@8	DR
				60	10	DR	DR	6@22	6@28	DR	DR	DR
160	136	125	3	30	8	4@18	5@34	4@48	4@48	4@13	4@17	4@13
					10	4@13	5@34	4@48	4@48	4@10	4@16	4@9
				60	10	4@11	5@31	6@45	4@48	4@9	4@14	4@8
			6	30	10	DR	5@15	6@31	6@30	DR	4@7	DR
				60	10	DR	DR	6@21	6@27	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m^2.

a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet topographic factor, K_{zt}, equal to 1.0, and Risk Category II.

b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.

c. See Section R611.6.5 for location of reinforcement in wall.

d. Deflection criterion is *L*/240, where *L* is the height of the wall in inches from the exterior finish ground level to the top of the above-grade wall.

e. Interpolation is not permitted. For intermediate values of basic wind speed, heights of stem wall and above-grade wall, and design lateral soil load, use next higher value.

f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.

g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. In waffle and screen-grid walls where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section R611.5.4.7 and Table R611.5.4(2).

h. Height of stem wall is the distance from the exterior finish ground level to the top of the slab-on-ground.

i. Where the distance from the exterior finish ground level to the top of the slab-on-ground is equal to or greater than 4 feet, the stem wall shall be laterally supported at the top and bottom before backfilling. Where the wall is designed and constructed to be continuous with the above-grade wall, temporary supports bracing the top of the stem wall shall remain in place until the above-grade wall is laterally supported at the top by floor or roof construction.

j. See Table R611.3 for tolerances on nominal thicknesses, and minimum core dimensions and maximum spacing of horizontal and vertical cores for waffle- and screen-grid walls.

k. Tabulated values are applicable to construction where gravity loads bear on top of wall, and conditions where gravity loads from floor construction are transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. See Tables R611.6(1), R611.6(2) and R611.6(3).

l. DR indicates design required.

R611.7.1.1 Length of solid wall for wind. All buildings shall have solid walls in each exterior endwall line (the side of a building that is parallel to the span of the roof or floor framing) and sidewall line (the side of a building that is perpendicular to the span of the roof or floor framing) to resist lateral in-plane wind forces. The site-appropriate basic wind speed and exposure category shall be used in Tables R611.7(1A) through (1C) to determine the unreduced total length, *UR,* of solid wall required in each exterior endwall line and sidewall line. For buildings with a mean roof height of less than 35 feet (10,668 mm), the unreduced values determined from Tables R611.7(1A) though (1C) ~~is~~ are permitted to be reduced by multiplying by the applicable factor, R_1, from Table R611.7(2); however, reduced values shall not be less than the minimum values in Tables R611.7(1A) through (1C). Where the floor-to-ceiling height of a *story* is less than 10 feet (3048 mm), the unreduced values determined from Tables R611.7(1A) through (C), including minimum values, is are permitted to be reduced by multiplying by the applicable factor, R_2, from Table R611.7(3). To account for different design strengths than assumed in determining the values in Tables R611.7(1A) through (1C), the unreduced lengths determined from Tables R611.7(1A) through (1C), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_3, from Table R611.7(4). The reductions permitted by Tables R611.7(2), R611.7(3) and R611.7(4) are cumulative.

The total length of solid wall segments, *TL,* in a wall line that comply with the minimum length requirements of Section R611.7.2.1 [see Figure R611.7(1)] shall be equal to or greater than the product of the unreduced length of solid wall from Tables R611.7(1A) through (1C), *UR* and the applicable reduction factors, if any, from Tables R611.7(2), R611.7(3) and R611.7(4) as indicated by Equation R6-1.

$$TL \geq R_1 \bullet R_2 \bullet R_3 \bullet UR \qquad \textbf{(Equation R6-1)}$$

where:

TL = Total length of solid wall segments in a wall line that comply with Section R611.7.2.1 [see Figure R611.7(1)];

R_1 = 1.0 or reduction factor for mean roof height from Table R611.7(2);

R_2 = 1.0 or reduction factor for floor-to-ceiling wall height from Table R611.7(3);

R_3 = 1.0 or reduction factor for design strength from Table R611.7(4), and

UR = Unreduced length of solid wall from Tables R611.7(1A) through (1C).

The total length of solid wall in a wall line, *TL,* shall not be less than that provided by two solid wall segments complying with the minimum length requirements of Section R611.7.2.1.

To facilitate determining the required wall thickness, wall type, number and *grade* of vertical bars at the each end of each solid wall segment, and whether shear reinforcement is required, use of Equation R6-2 is permitted.

$$R_{\underline{3}} \leq \frac{TL}{R_1 \,.\, R_2 \,.\, UR} \qquad \textbf{(Equation R6-2)}$$

After determining the maximum permitted value of the reduction factor for design strength, R_3, in accordance with Equation R6-2, select a wall type from Table R611.7(4) with R_3 less than or equal to the value calculated.

~~TABLE R611.7(1A)~~
~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL~~
~~FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO STORY~~[a, c, d, e, f, g]

~~SIDEWALL LENGTH (feet)~~	**~~ENDWALL LENGTH (feet)~~**	**~~ROOF SLOPE~~**	**~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)~~**						
			~~Basic Wind Speed (mph) Exposure~~						
			~~85B~~	**~~90B~~**	**~~100B~~**	**~~110B~~**	**~~120B~~**	**~~130B~~**	**~~Minimum~~[b]**
			-	-	**~~85C~~**	**~~90C~~**	**~~100C~~**	**~~110C~~**	
			-	-	-	**~~85D~~**	**~~90D~~**	**~~100D~~**	
~~15~~	~~15~~	~~< 1:12~~	~~0.90~~	~~1.01~~	~~1.25~~	~~1.51~~	~~1.80~~	~~2.11~~	~~0.98~~
		~~5:12~~	~~1.25~~	~~1.40~~	~~1.73~~	~~2.09~~	~~2.49~~	~~2.92~~	~~1.43~~
		~~7:12~~	~~1.75~~	~~1.96~~	~~2.43~~	~~2.93~~	~~3.49~~	~~4.10~~	~~1.64~~
		~~12:12~~	~~2.80~~	~~3.13~~	~~3.87~~	~~4.68~~	~~5.57~~	~~6.54~~	~~2.21~~
	~~30~~	~~< 1:12~~	~~0.90~~	~~1.01~~	~~1.25~~	~~1.51~~	~~1.80~~	~~2.11~~	~~1.09~~
		~~5:12~~	~~1.25~~	~~1.40~~	~~1.73~~	~~2.09~~	~~2.49~~	~~2.92~~	~~2.01~~
		~~7:12~~	~~2.43~~	~~2.73~~	~~3.37~~	~~4.08~~	~~4.85~~	~~5.69~~	~~2.42~~
		~~12:12~~	~~4.52~~	~~5.07~~	~~6.27~~	~~7.57~~	~~9.01~~	~~10.58~~	~~3.57~~

	~~45~~	~~< 1:12~~	~~0.90~~	~~1.01~~	~~1.25~~	~~1.51~~	~~1.80~~	~~2.11~~	~~1.21~~
		~~5:12~~	~~1.25~~	~~1.40~~	~~1.73~~	~~2.09~~	~~2.49~~	~~2.92~~	~~2.59~~
		~~7:12~~	~~3.12~~	~~3.49~~	~~4.32~~	~~5.22~~	~~6.21~~	~~7.29~~	~~3.21~~
		~~12:12~~	~~6.25~~	~~7.00~~	~~8.66~~	~~10.47~~	~~12.45~~	~~14.61~~	~~4.93~~
	~~60~~	~~< 1:12~~	~~0.90~~	~~1.01~~	~~1.25~~	~~1.51~~	~~1.80~~	~~2.11~~	~~1.33~~
		~~5:12~~	~~1.25~~	~~1.40~~	~~1.73~~	~~2.09~~	~~2.49~~	~~2.92~~	~~3.16~~
		~~7:12~~	~~3.80~~	~~4.26~~	~~5.26~~	~~6.36~~	~~7.57~~	~~8.89~~	~~3.99~~
		~~12:12~~	~~7.97~~	~~8.94~~	~~11.05~~	~~13.36~~	~~15.89~~	~~18.65~~	~~6.29~~
~~30~~	~~15~~	~~< 1:12~~	~~1.61~~	~~1.80~~	~~2.23~~	~~2.70~~	~~3.21~~	~~3.77~~	~~1.93~~
		~~5:12~~	~~2.24~~	~~2.51~~	~~3.10~~	~~3.74~~	~~4.45~~	~~5.23~~	~~2.75~~
		~~7:12~~	~~3.15~~	~~3.53~~	~~4.37~~	~~5.28~~	~~6.28~~	~~7.37~~	~~3.12~~
		~~12:12~~	~~4.90~~	~~5.49~~	~~6.79~~	~~8.21~~	~~9.77~~	~~11.46~~	~~4.14~~
	~~30~~	~~< 1:12~~	~~1.61~~	~~1.80~~	~~2.23~~	~~2.70~~	~~3.21~~	~~3.77~~	~~2.14~~
		~~5:12~~	~~2.24~~	~~2.51~~	~~3.10~~	~~3.74~~	~~4.45~~	~~5.23~~	~~3.78~~
		~~7:12~~	~~4.30~~	~~4.82~~	~~5.96~~	~~7.20~~	~~8.57~~	~~10.05~~	~~4.52~~
		~~12:12~~	~~7.79~~	~~8.74~~	~~10.80~~	~~13.06~~	~~15.53~~	~~18.23~~	~~6.57~~
	~~45~~	~~< 1:12~~	~~1.61~~	~~1.80~~	~~2.23~~	~~2.70~~	~~3.21~~	~~3.77~~	~~2.35~~
		~~5:12~~	~~2.24~~	~~2.51~~	~~3.10~~	~~3.74~~	~~4.45~~	~~5.23~~	~~4.81~~
		~~7:12~~	~~5.44~~	~~6.10~~	~~7.54~~	~~9.12~~	~~10.85~~	~~12.73~~	~~5.92~~
		~~12:12~~	~~10.69~~	~~11.98~~	~~14.81~~	~~17.90~~	~~21.30~~	~~25.00~~	~~9.00~~
	~~60~~	~~< 1:12~~	~~1.61~~	~~1.80~~	~~2.23~~	~~2.70~~	~~3.21~~	~~3.77~~	~~2.56~~
		~~5:12~~	~~2.24~~	~~2.51~~	~~3.10~~	~~3.74~~	~~4.45~~	~~5.23~~	~~5.84~~
		~~7:12~~	~~6.59~~	~~7.39~~	~~9.13~~	~~11.04~~	~~13.14~~	~~15.41~~	~~7.32~~
		~~12:12~~	~~13.58~~	~~15.22~~	~~18.82~~	~~22.75~~	~~27.07~~	~~31.77~~	~~11.43~~
~~60~~	~~15~~	~~< 1:12~~	~~2.99~~	~~3.35~~	~~4.14~~	~~5.00~~	~~5.95~~	~~6.98~~	~~3.83~~
		~~5:12~~	~~4.15~~	~~4.65~~	~~5.75~~	~~6.95~~	~~8.27~~	~~9.70~~	~~5.37~~
		~~7:12~~	~~5.91~~	~~6.63~~	~~8.19~~	~~9.90~~	~~11.78~~	~~13.83~~	~~6.07~~
		~~12:12~~	~~9.05~~	~~10.14~~	~~12.54~~	~~15.16~~	~~18.03~~	~~21.16~~	~~8.00~~
	~~30~~	~~< 1:12~~	~~2.99~~	~~3.35~~	~~4.14~~	~~5.00~~	~~5.95~~	~~6.98~~	~~4.23~~
		~~5:12~~	~~4.15~~	~~4.65~~	~~5.75~~	~~6.95~~	~~8.27~~	~~9.70~~	~~7.31~~
		~~7:12~~	~~7.97~~	~~8.94~~	~~11.05~~	~~13.36~~	~~15.89~~	~~18.65~~	~~8.71~~
		~~12:12~~	~~14.25~~	~~15.97~~	~~19.74~~	~~23.86~~	~~28.40~~	~~33.32~~	~~12.57~~
	~~45~~	~~< 1:12~~	~~3.11~~	~~3.48~~	~~4.30~~	~~5.20~~	~~6.19~~	~~7.26~~	~~4.63~~

		~~5:12~~	~~4.31~~	~~4.84~~	~~5.98~~	~~7.23~~	~~8.60~~	~~10.09~~	~~9.25~~
		~~7:12~~	~~10.24~~	~~11.47~~	~~14.19~~	~~17.15~~	~~20.40~~	~~23.84~~	~~11.35~~
		~~12:12~~	~~19.84~~	~~22.24~~	~~27.49~~	~~33.23~~	~~39.54~~	~~46.40~~	~~17.14~~
	~~60~~	~~< 1:12~~	~~3.22~~	~~3.61~~	~~4.46~~	~~5.39~~	~~6.42~~	~~7.53~~	~~5.03~~
		~~5:12~~	~~4.47~~	~~5.01~~	~~6.19~~	~~7.49~~	~~8.91~~	~~10.46~~	~~11.19~~
		~~7:12~~	~~12.57~~	~~14.09~~	~~17.42~~	~~21.05~~	~~25.05~~	~~29.39~~	~~13.99~~
		~~12:12~~	~~25.61~~	~~28.70~~	~~35.49~~	~~42.90~~	~~51.04~~	~~59.90~~	~~21.71~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound-force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.~~

~~a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table R611.7(1A) or R611.7(1B) or sidewall (Table R611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.~~

~~b. Tabulated lengths in the "minimum" column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main windforce-resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.~~

~~c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor,~~ R_1~~, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.~~

~~d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor,~~ R_2~~, from Table R611.7(3).~~

~~e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength,~~ R_3~~, from Table R611.7(4).~~

~~f. The reduction factors,~~ R_1~~,~~ R_2 ~~and~~ R_3~~, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.~~

~~g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.~~

TABLE R611.7(1A)
UNREDUCED LENGTH, *UR,* OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO STORY[a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR,* OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	Minimum[b]
					110C	119C	127C	136C	
						110D	117D	125D	
15	15	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.92
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.15
		7:12	2.00	2.18	2.56	2.97	3.41	3.88	1.25
		12:12	3.20	3.48	4.09	4.74	5.44	6.19	1.54
	30	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.98
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.43
		7:12	2.78	3.03	3.56	4.13	4.74	5.39	1.64

		12:12	5.17	5.63	6.61	7.67	8.80	10.01	2.21
	45	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.04
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.72
		7:12	3.57	3.88	4.56	5.28	6.07	6.90	2.03
		12:12	7.15	7.78	9.13	10.59	12.16	13.84	2.89
	60	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.09
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	2.01
		7:12	4.35	4.73	5.55	6.44	7.39	8.41	2.42
		12:12	9.12	9.93	11.66	13.52	15.52	17.66	3.57
30	15	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.82
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.23
		7:12	3.61	3.93	4.61	5.34	6.13	6.98	2.42
		12:12	5.61	6.10	7.16	8.31	9.54	10.85	2.93
	30	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.93
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.75
		7:12	4.92	5.35	6.28	7.29	8.37	9.52	3.12
		12:12	8.92	9.71	11.39	13.22	15.17	17.26	4.14
	45	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.03
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.26
		7:12	6.23	6.78	7.96	9.23	10.60	12.06	3.82
		12:12	12.23	13.31	15.63	18.12	20.80	23.67	5.36
	60	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.14
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.78
		7:12	7.54	8.21	9.64	11.17	12.83	14.60	4.52
		12:12	15.54	16.92	19.86	23.03	26.44	30.08	6.57
60	15	< 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.63
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	4.40
		7:12	6.76	7.36	8.64	10.02	11.51	13.09	4.75
		12:12	10.35	11.27	13.23	15.34	17.61	20.04	5.71
	30	< 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.83
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	5.37
		7:12	9.12	9.93	11.66	13.52	15.52	17.66	6.07
		12:12	16.30	17.75	20.83	24.16	27.73	31.55	8.00
	45	< 1:12	3.55	3.87	4.54	5.27	6.05	6.88	4.03
		5:12	4.94	5.37	6.31	7.31	8.40	9.55	6.34
		7:12	11.71	12.75	14.97	17.36	19.93	22.67	7.39
		12:12	22.70	24.71	29.00	33.64	38.62	43.94	10.29
	60	< 1:12	3.68	4.01	4.71	5.46	6.27	7.13	4.23
		5:12	5.11	5.57	6.54	7.58	8.70	9.90	7.31
		7:12	14.38	15.66	18.37	21.31	24.46	27.83	8.71
		12:12	29.30	31.90	37.44	43.42	49.85	56.72	12.57

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound-force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, **UR,** of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.

c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2, from Table R611.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3, from Table R611.7(4).

f. The reduction factors, R_1, R_2 and R_3, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

~~TABLE R611.7(1B)~~
~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL~~
~~FOR WIND PERPENDICULAR TO RIDGE FIRST STORY OF TWO STORY~~[a, c, d, e, f, g]

~~SIDEWALL LENGTH (feet)~~	~~ENDWALL LENGTH (feet)~~	~~ROOF SLOPE~~	~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)~~						
			~~Basic Wind Speed (mph) Exposure~~						
			~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~	~~Minimum~~[b]
			-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~	
			-	-	-	~~85D~~	~~90D~~	~~100D~~	
			~~Velocity pressure (psf)~~						
			~~11.51~~	~~12.90~~	~~15.95~~	~~19.28~~	~~22.94~~	~~26.92~~	-
~~15~~	~~15~~	~~< 1:12~~	~~2.60~~	~~2.92~~	~~3.61~~	~~4.36~~	~~5.19~~	~~6.09~~	~~2.59~~
		~~5:12~~	~~3.61~~	~~4.05~~	~~5.00~~	~~6.05~~	~~7.20~~	~~8.45~~	~~3.05~~
		~~7:12~~	~~3.77~~	~~4.23~~	~~5.23~~	~~6.32~~	~~7.52~~	~~8.82~~	~~3.26~~
		~~12:12~~	~~4.81~~	~~5.40~~	~~6.67~~	~~8.06~~	~~9.60~~	~~11.26~~	~~3.83~~
	~~30~~	~~< 1:12~~	~~2.60~~	~~2.92~~	~~3.61~~	~~4.36~~	~~5.19~~	~~6.09~~	~~2.71~~
		~~5:12~~	~~3.61~~	~~4.05~~	~~5.00~~	~~6.05~~	~~7.20~~	~~8.45~~	~~3.63~~
		~~7:12~~	~~4.45~~	~~4.99~~	~~6.17~~	~~7.46~~	~~8.88~~	~~10.42~~	~~4.04~~
		~~12:12~~	~~6.54~~	~~7.33~~	~~9.06~~	~~10.96~~	~~13.04~~	~~15.30~~	~~5.19~~
	~~45~~	~~< 1:12~~	~~2.60~~	~~2.92~~	~~3.61~~	~~4.36~~	~~5.19~~	~~6.09~~	~~2.83~~
		~~5:12~~	~~3.61~~	~~4.05~~	~~5.00~~	~~6.05~~	~~7.20~~	~~8.45~~	~~4.20~~
		~~7:12~~	~~5.14~~	~~5.76~~	~~7.12~~	~~8.60~~	~~10.24~~	~~12.01~~	~~4.83~~

		~~12:12~~	~~8.27~~	~~9.27~~	~~11.46~~	~~13.85~~	~~16.48~~	~~19.34~~	~~6.55~~
	~~60~~	~~< 1:12~~	~~2.60~~	~~2.92~~	~~3.61~~	~~4.36~~	~~5.19~~	~~6.09~~	~~2.95~~
		~~5:12~~	~~3.61~~	~~4.05~~	~~5.00~~	~~6.05~~	~~7.20~~	~~8.45~~	~~4.78~~
		~~7:12~~	~~5.82~~	~~6.52~~	~~8.06~~	~~9.75~~	~~11.60~~	~~13.61~~	~~5.61~~
		~~12:12~~	~~9.99~~	~~11.20~~	~~13.85~~	~~16.74~~	~~19.92~~	~~23.37~~	~~7.90~~
~~30~~	~~15~~	~~< 1:12~~	~~4.65~~	~~5.21~~	~~6.45~~	~~7.79~~	~~9.27~~	~~10.88~~	~~5.16~~
		~~5:12~~	~~6.46~~	~~7.24~~	~~8.95~~	~~10.82~~	~~12.87~~	~~15.10~~	~~5.98~~
		~~7:12~~	~~6.94~~	~~7.78~~	~~9.62~~	~~11.62~~	~~13.83~~	~~16.23~~	~~6.35~~
		~~12:12~~	~~8.69~~	~~9.74~~	~~12.04~~	~~14.55~~	~~17.32~~	~~20.32~~	~~7.38~~
	~~30~~	~~< 1:12~~	~~4.65~~	~~5.21~~	~~6.45~~	~~7.79~~	~~9.27~~	~~10.88~~	~~5.38~~
		~~5:12~~	~~6.46~~	~~7.24~~	~~8.95~~	~~10.82~~	~~12.87~~	~~15.10~~	~~7.01~~
		~~7:12~~	~~8.09~~	~~9.06~~	~~11.21~~	~~13.54~~	~~16.12~~	~~18.91~~	~~7.76~~
		~~12:12~~	~~11.58~~	~~12.98~~	~~16.05~~	~~19.40~~	~~23.08~~	~~27.09~~	~~9.81~~
	~~45~~	~~< 1:12~~	~~4.65~~	~~5.21~~	~~6.45~~	~~7.79~~	~~9.27~~	~~10.88~~	~~5.59~~
		~~5:12~~	~~6.46~~	~~7.24~~	~~8.95~~	~~10.82~~	~~12.87~~	~~15.10~~	~~8.04~~
		~~7:12~~	~~9.23~~	~~10.35~~	~~12.79~~	~~15.46~~	~~18.40~~	~~21.59~~	~~9.16~~
		~~12:12~~	~~14.48~~	~~16.22~~	~~20.06~~	~~24.25~~	~~28.85~~	~~33.86~~	~~12.24~~
	~~60~~	~~< 1:12~~	~~4.65~~	~~5.21~~	~~6.45~~	~~7.79~~	~~9.27~~	~~10.88~~	~~5.80~~
		~~5:12~~	~~6.46~~	~~7.24~~	~~8.95~~	~~10.82~~	~~12.87~~	~~15.10~~	~~9.08~~
		~~7:12~~	~~10.38~~	~~11.63~~	~~14.38~~	~~17.38~~	~~20.69~~	~~24.27~~	~~10.56~~
		~~12:12~~	~~17.37~~	~~19.47~~	~~24.07~~	~~29.10~~	~~34.62~~	~~40.63~~	~~14.67~~
~~60~~	~~15~~	~~< 1:12~~	~~8.62~~	~~9.67~~	~~11.95~~	~~14.45~~	~~17.19~~	~~20.17~~	~~10.30~~
		~~5:12~~	~~11.98~~	~~13.43~~	~~16.61~~	~~20.07~~	~~23.88~~	~~28.03~~	~~11.85~~
		~~7:12~~	~~13.18~~	~~14.78~~	~~18.27~~	~~22.08~~	~~26.28~~	~~30.83~~	~~12.54~~
		~~12:12~~	~~16.32~~	~~18.29~~	~~22.62~~	~~27.34~~	~~32.53~~	~~38.17~~	~~14.48~~
	~~30~~	~~< 1:12~~	~~8.62~~	~~9.67~~	~~11.95~~	~~14.45~~	~~17.19~~	~~20.17~~	~~10.70~~
		~~5:12~~	~~11.98~~	~~13.43~~	~~16.61~~	~~20.07~~	~~23.88~~	~~28.03~~	~~13.79~~
		~~7:12~~	~~15.25~~	~~17.09~~	~~21.13~~	~~25.54~~	~~30.38~~	~~35.66~~	~~15.18~~
		~~12:12~~	~~21.52~~	~~24.12~~	~~29.82~~	~~36.05~~	~~42.89~~	~~50.33~~	~~19.05~~
	~~45~~	~~< 1:12~~	~~8.97~~	~~10.06~~	~~12.43~~	~~15.03~~	~~17.88~~	~~20.99~~	~~11.10~~
		~~5:12~~	~~12.46~~	~~13.97~~	~~17.27~~	~~20.88~~	~~24.84~~	~~29.15~~	~~15.73~~
		~~7:12~~	~~17.67~~	~~19.80~~	~~24.48~~	~~29.59~~	~~35.21~~	~~41.32~~	~~17.82~~
		~~12:12~~	~~27.27~~	~~30.56~~	~~37.79~~	~~45.68~~	~~54.35~~	~~63.78~~	~~23.62~~

	~~60~~	~~< 1:12~~	~~9.30~~	~~10.43~~	~~12.89~~	~~15.58~~	~~18.54~~	~~21.76~~	~~11.50~~
		~~5:12~~	~~12.91~~	~~14.47~~	~~17.90~~	~~21.63~~	~~25.74~~	~~30.20~~	~~17.67~~
		~~7:12~~	~~20.14~~	~~22.58~~	~~27.91~~	~~33.74~~	~~40.15~~	~~47.11~~	~~20.46~~
		~~12:12~~	~~33.19~~	~~37.19~~	~~45.99~~	~~55.59~~	~~66.14~~	~~77.62~~	~~28.19~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.~~

~~a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table R611.7(1A) or R611.7(1B)] or sidewall [Table R611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.~~

~~b. Tabulated lengths in the "minimum" column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main windforce-resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.~~

~~c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.~~

~~d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2, from Table R611.7(3).~~

~~e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3, from Table R611.7(4).~~

~~f. The reduction factors, R_1, R_2 and R_3, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.~~

~~g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.~~

TABLE R611.7(1B)
UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO RIDGE FIRST STORY OF TWO STORY[a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	Minimum[b]
					110C	119C	127C	136C	
						110D	117D	125D	
15	15	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.54
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	2.76
		7:12	4.31	4.70	5.51	6.39	7.34	8.35	2.87
		12:12	5.51	6.00	7.04	8.16	9.37	10.66	3.15
	30	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.59
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.05
		7:12	5.09	5.55	6.51	7.55	8.67	9.86	3.26
		12:12	7.48	8.15	9.56	11.09	12.73	14.49	3.83
	45	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.65
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.34
		7:12	5.88	6.40	7.51	8.71	10.00	11.37	3.65

		12:12	9.46	10.30	12.09	14.02	16.09	18.31	4.51
	60	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.71
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.63
		7:12	6.66	7.25	8.51	9.87	11.32	12.89	4.04
		12:12	11.43	12.45	14.61	16.94	19.45	22.13	5.19
30	15	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.06
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.47
		7:12	7.94	8.65	10.15	11.77	13.51	15.37	5.65
		12:12	9.94	10.82	12.70	14.73	16.91	19.24	6.17
	30	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.16
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.98
		7:12	9.25	10.07	11.82	13.71	15.74	17.91	6.35
		12:12	13.25	14.43	16.93	19.64	22.54	25.65	7.38
	45	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.27
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	6.50
		7:12	10.56	11.50	13.50	15.65	17.97	20.45	7.06
		12:12	16.56	18.03	21.16	24.55	28.18	32.06	8.60
	60	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.38
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	7.01
		7:12	11.87	12.93	15.17	17.60	20.20	22.98	7.76
		12:12	19.87	21.64	25.40	29.45	33.81	38.47	9.81
60	15	< 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.10
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	10.87
		7:12	15.08	16.42	19.27	22.35	25.66	29.20	11.22
		12:12	18.67	20.33	23.86	27.67	31.77	36.14	12.19
	30	< 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.30
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	11.85
		7:12	17.44	18.99	22.29	25.85	29.67	33.76	12.54
		12:12	24.62	26.81	31.46	36.49	41.89	47.66	14.48
	45	< 1:12	10.27	11.18	13.12	15.21	17.47	19.87	10.50
		5:12	14.26	15.52	18.22	21.13	24.26	27.60	12.82
		7:12	20.21	22.01	25.83	29.95	34.39	39.12	13.86
		12:12	31.20	33.97	39.87	46.23	53.07	60.39	16.76
	60	< 1:12	10.64	11.59	13.60	15.77	18.11	20.60	10.70
		5:12	14.77	16.09	18.88	21.90	25.14	28.60	13.79
		7:12	23.05	25.09	29.45	34.15	39.21	44.61	15.18
		12:12	37.97	41.34	48.52	56.27	64.60	73.49	19.05

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, **UR,** of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of ~~10~~16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.

c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2, from Table R611.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3, from Table R611.7(4).

f. The reduction factors, R_1, R_2 and R_3, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

~~TABLE R611.7(1C)~~
~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE~~[a, c, d, e, f, g]

~~SIDEWALL LENGTH (feet)~~	~~ENDWALL LENGTH (feet)~~	~~ROOF SLOPE~~	~~UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)~~						
			~~Basic Wind Speed (mph) Exposure~~						
			~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~	~~Minimum~~[b]
			-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~	
			-	-	-	~~85D~~	~~90D~~	~~100D~~	
			~~One story or top story of two story~~						
~~< 30~~	~~15~~	~~< 1:12~~	~~0.95~~	~~1.06~~	~~1.31~~	~~1.59~~	~~1.89~~	~~2.22~~	~~0.90~~
		~~5:12~~	~~1.13~~	~~1.26~~	~~1.56~~	~~1.88~~	~~2.24~~	~~2.63~~	~~1.08~~
		~~7:12~~	~~1.21~~	~~1.35~~	~~1.67~~	~~2.02~~	~~2.40~~	~~2.82~~	~~1.17~~
		~~12:12~~	~~1.43~~	~~1.60~~	~~1.98~~	~~2.39~~	~~2.85~~	~~3.34~~	~~1.39~~
	~~30~~	~~< 1:12~~	~~1.77~~	~~1.98~~	~~2.45~~	~~2.96~~	~~3.53~~	~~4.14~~	~~1.90~~
		~~5:12~~	~~2.38~~	~~2.67~~	~~3.30~~	~~3.99~~	~~4.75~~	~~5.57~~	~~2.62~~
		~~7:12~~	~~2.66~~	~~2.98~~	~~3.69~~	~~4.46~~	~~5.31~~	~~6.23~~	~~2.95~~
		~~12:12~~	~~3.43~~	~~3.85~~	~~4.76~~	~~5.75~~	~~6.84~~	~~8.03~~	~~3.86~~
	~~45~~	~~< 1:12~~	~~2.65~~	~~2.97~~	~~3.67~~	~~4.43~~	~~5.27~~	~~6.19~~	~~2.99~~
		~~5:12~~	~~3.98~~	~~4.46~~	~~5.51~~	~~6.66~~	~~7.93~~	~~9.31~~	~~4.62~~
		~~7:12~~	~~4.58~~	~~5.14~~	~~6.35~~	~~7.68~~	~~9.14~~	~~10.72~~	~~5.36~~
		~~12:12~~	~~6.25~~	~~7.01~~	~~8.67~~	~~10.48~~	~~12.47~~	~~14.63~~	~~7.39~~
	~~60~~	~~< 1:12~~	~~3.59~~	~~4.03~~	~~4.98~~	~~6.02~~	~~7.16~~	~~8.40~~	~~4.18~~
		~~5:12~~	~~5.93~~	~~6.65~~	~~8.22~~	~~9.93~~	~~11.82~~	~~13.87~~	~~7.07~~
		~~7:12~~	~~6.99~~	~~7.83~~	~~9.69~~	~~11.71~~	~~13.93~~	~~16.35~~	~~8.38~~

		~~12:12~~	~~9.92~~	~~11.12~~	~~13.75~~	~~16.62~~	~~19.77~~	~~23.21~~	~~12.00~~
~~60~~	~~45~~	~~< 1:12~~	~~2.77~~	~~3.11~~	~~3.84~~	~~4.65~~	~~5.53~~	~~6.49~~	~~2.99~~
		~~5:12~~	~~4.15~~	~~4.66~~	~~5.76~~	~~6.96~~	~~8.28~~	~~9.72~~	~~4.62~~
		~~7:12~~	~~4.78~~	~~5.36~~	~~6.63~~	~~8.01~~	~~9.53~~	~~11.18~~	~~5.36~~
		~~12:12~~	~~6.51~~	~~7.30~~	~~9.03~~	~~10.91~~	~~12.98~~	~~15.23~~	~~7.39~~
	~~60~~	~~< 1:12~~	~~3.86~~	~~4.32~~	~~5.35~~	~~6.46~~	~~7.69~~	~~9.02~~	~~4.18~~
		~~5:12~~	~~6.31~~	~~7.08~~	~~8.75~~	~~10.57~~	~~12.58~~	~~14.76~~	~~7.07~~
		~~7:12~~	~~7.43~~	~~8.32~~	~~10.29~~	~~12.44~~	~~14.80~~	~~17.37~~	~~8.38~~
		~~12:12~~	~~10.51~~	~~11.78~~	~~14.56~~	~~17.60~~	~~20.94~~	~~24.57~~	~~12.00~~
~~First story of two story~~									
~~< 30~~	~~15~~	~~< 1:12~~	~~2.65~~	~~2.97~~	~~3.67~~	~~4.44~~	~~5.28~~	~~6.20~~	~~2.52~~
		~~5:12~~	~~2.83~~	~~3.17~~	~~3.92~~	~~4.74~~	~~5.64~~	~~6.62~~	~~2.70~~
		~~7:12~~	~~2.91~~	~~3.26~~	~~4.03~~	~~4.87~~	~~5.80~~	~~6.80~~	~~2.79~~
		~~12:12~~	~~3.13~~	~~3.51~~	~~4.34~~	~~5.25~~	~~6.24~~	~~7.32~~	~~3.01~~
	~~30~~	~~< 1:12~~	~~4.81~~	~~5.39~~	~~6.67~~	~~8.06~~	~~9.59~~	~~11.25~~	~~5.14~~
		~~5:12~~	~~5.42~~	~~6.08~~	~~7.52~~	~~9.09~~	~~10.81~~	~~12.69~~	~~5.86~~
		~~7:12~~	~~5.70~~	~~6.39~~	~~7.90~~	~~9.55~~	~~11.37~~	~~13.34~~	~~6.19~~
		~~12:12~~	~~6.47~~	~~7.25~~	~~8.97~~	~~10.84~~	~~12.90~~	~~15.14~~	~~7.10~~
	~~45~~	~~< 1:12~~	~~6.99~~	~~7.83~~	~~9.69~~	~~11.71~~	~~13.93~~	~~16.35~~	~~7.85~~
		~~5:12~~	~~8.32~~	~~9.33~~	~~11.53~~	~~13.94~~	~~16.59~~	~~19.47~~	~~9.48~~
		~~7:12~~	~~8.93~~	~~10.01~~	~~12.37~~	~~14.95~~	~~17.79~~	~~20.88~~	~~10.21~~
		~~12:12~~	~~10.60~~	~~11.88~~	~~14.69~~	~~17.75~~	~~21.13~~	~~24.79~~	~~12.25~~
	~~60~~	~~< 1:12~~	~~9.23~~	~~10.35~~	~~12.79~~	~~15.46~~	~~18.40~~	~~21.59~~	~~10.65~~
		~~5:12~~	~~11.57~~	~~12.97~~	~~16.03~~	~~19.38~~	~~23.06~~	~~27.06~~	~~13.54~~
		~~7:12~~	~~12.63~~	~~14.15~~	~~17.50~~	~~21.15~~	~~25.17~~	~~29.54~~	~~14.85~~
		~~12:12~~	~~15.56~~	~~17.44~~	~~21.56~~	~~26.06~~	~~31.01~~	~~36.39~~	~~18.48~~
~~60~~	~~45~~	~~< 1:12~~	~~7.34~~	~~8.22~~	~~10.17~~	~~12.29~~	~~14.62~~	~~17.16~~	~~7.85~~
		~~5:12~~	~~8.72~~	~~9.77~~	~~12.08~~	~~14.60~~	~~17.37~~	~~20.39~~	~~9.48~~
		~~7:12~~	~~9.34~~	~~10.47~~	~~12.95~~	~~15.65~~	~~18.62~~	~~21.85~~	~~10.21~~
		~~12:12~~	~~11.08~~	~~12.41~~	~~15.35~~	~~18.55~~	~~22.07~~	~~25.90~~	~~12.25~~
	~~60~~	~~< 1:12~~	~~9.94~~	~~11.14~~	~~13.77~~	~~16.65~~	~~19.81~~	~~23.25~~	~~10.65~~
		~~5:12~~	~~12.40~~	~~13.89~~	~~17.18~~	~~20.76~~	~~24.70~~	~~28.99~~	~~13.54~~
		~~7:12~~	~~13.51~~	~~15.14~~	~~18.72~~	~~22.63~~	~~26.92~~	~~31.60~~	~~14.85~~

		~~12:12~~	~~16.59~~	~~18.59~~	~~22.99~~	~~27.79~~	~~33.06~~	~~38.80~~	~~18.48~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.~~

~~a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table R611.7(1A) or R611.7(1B)] or sidewall [(Table R611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.~~

~~b. Tabulated lengths in the "minimum" column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main windforce-resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.~~

~~c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor,~~ R_1~~, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.~~

~~d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor,~~ R_2~~, from Table R611.7(3).~~

~~e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength,~~ R_3~~, from Table R611.7(4).~~

~~f. The reduction factors,~~ R_1~~,~~ R_2 ~~and~~ R_3~~, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.~~

~~g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.~~

TABLE R611.7(1C)
UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE[a, c, d, e, f, g]

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN SIDEWALLS FOR WIND PARALLEL TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	Minimum[b]
					110C	119C	127C	136C	
						110D	117D	125D	
			One story or top story of two story						
< 30	15	< 1:12	1.08	1.18	1.39	1.61	1.84	2.10	0.90
		5:12	1.29	1.40	1.65	1.91	2.19	2.49	1.08
		7:12	1.38	1.50	1.76	2.04	2.35	2.67	1.17
		12:12	1.63	1.78	2.09	2.42	2.78	3.16	1.39
	30	< 1:12	2.02	2.20	2.59	3.00	3.44	3.92	1.90
		5:12	2.73	2.97	3.48	4.04	4.64	5.28	2.62
		7:12	3.05	3.32	3.89	4.51	5.18	5.89	2.95
		12:12	3.93	4.27	5.02	5.82	6.68	7.60	3.86
	45	< 1:12	3.03	3.30	3.87	4.49	5.15	5.86	2.99
		5:12	4.55	4.96	5.82	6.75	7.74	8.81	4.62
		7:12	5.24	5.71	6.70	7.77	8.92	10.15	5.36
		12:12	7.16	7.79	9.14	10.61	12.17	13.85	7.39
	60	< 1:12	4.11	4.47	5.25	6.09	6.99	7.96	4.18
		5:12	6.78	7.39	8.67	10.05	11.54	13.13	7.07
		7:12	8.00	8.71	10.22	11.85	13.61	15.48	8.38

		12:12	11.35	12.36	14.51	16.82	19.31	21.97	12.00
60	45	< 1:12	3.17	3.46	4.06	4.70	5.40	6.14	2.99
		5:12	4.75	5.18	6.07	7.04	8.09	9.20	4.62
		7:12	5.47	5.96	6.99	8.11	9.31	10.59	5.36
		12:12	7.45	8.11	9.52	11.04	12.68	14.43	7.39
	60	< 1:12	4.41	4.81	5.64	6.54	7.51	8.54	4.18
		5:12	7.22	7.86	9.23	10.70	12.29	13.98	7.07
		7:12	8.50	9.25	10.86	12.59	14.46	16.45	8.38
		12:12	12.02	13.09	15.36	17.81	20.45	23.27	12.00
First story of two story									
< 30	15	< 1:12	3.03	3.30	3.88	4.49	5.16	5.87	2.52
		5:12	3.24	3.52	4.14	4.80	5.51	6.26	2.70
		7:12	3.33	3.62	4.25	4.93	5.66	6.44	2.79
		12:12	3.58	3.90	4.58	5.31	6.10	6.94	3.01
	30	< 1:12	5.50	5.99	7.03	8.16	9.36	10.65	5.14
		5:12	6.21	6.76	7.93	9.20	10.56	12.01	5.86
		7:12	6.52	7.10	8.34	9.67	11.10	12.63	6.19
		12:12	7.41	8.06	9.46	10.97	12.60	14.33	7.10
	45	< 1:12	8.00	8.71	10.22	11.85	13.61	15.48	7.85
		5:12	9.52	10.37	12.17	14.11	16.20	18.43	9.48
		7:12	10.21	11.12	13.05	15.14	17.38	19.77	10.21
		12:12	12.13	13.20	15.50	17.97	20.63	23.47	12.25
	60	< 1:12	10.56	11.50	13.50	15.65	17.97	20.44	10.65
		5:12	13.24	14.41	16.91	19.62	22.52	25.62	13.54
		7:12	14.45	15.73	18.46	21.41	24.58	27.97	14.85
		12:12	17.80	19.38	22.75	26.38	30.29	34.46	18.48
60	45	< 1:12	8.39	9.14	10.72	12.44	14.28	16.25	7.85
		5:12	9.97	10.86	12.74	14.78	16.97	19.30	9.48
		7:12	10.69	11.64	13.66	15.84	18.19	20.69	10.21
		12:12	12.67	13.80	16.19	18.78	21.56	24.53	12.25
	60	< 1:12	11.37	12.38	14.53	16.85	19.35	22.01	10.65
		5:12	14.18	15.44	18.12	21.02	24.13	27.45	13.54
		7:12	15.46	16.83	19.75	22.91	26.29	29.92	14.85
		12:12	18.98	20.66	24.25	28.13	32.29	36.74	18.48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt}, equal to 1.0, and Risk Category II.~~.~~ The design pressures were used to calculate forces to be resisted by solid wall segments in each sidewall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, UR, of solid wall length required in each sidewall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.

b. Tabulated lengths in the "minimum" column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the "minimum" value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R611.7.1.1.

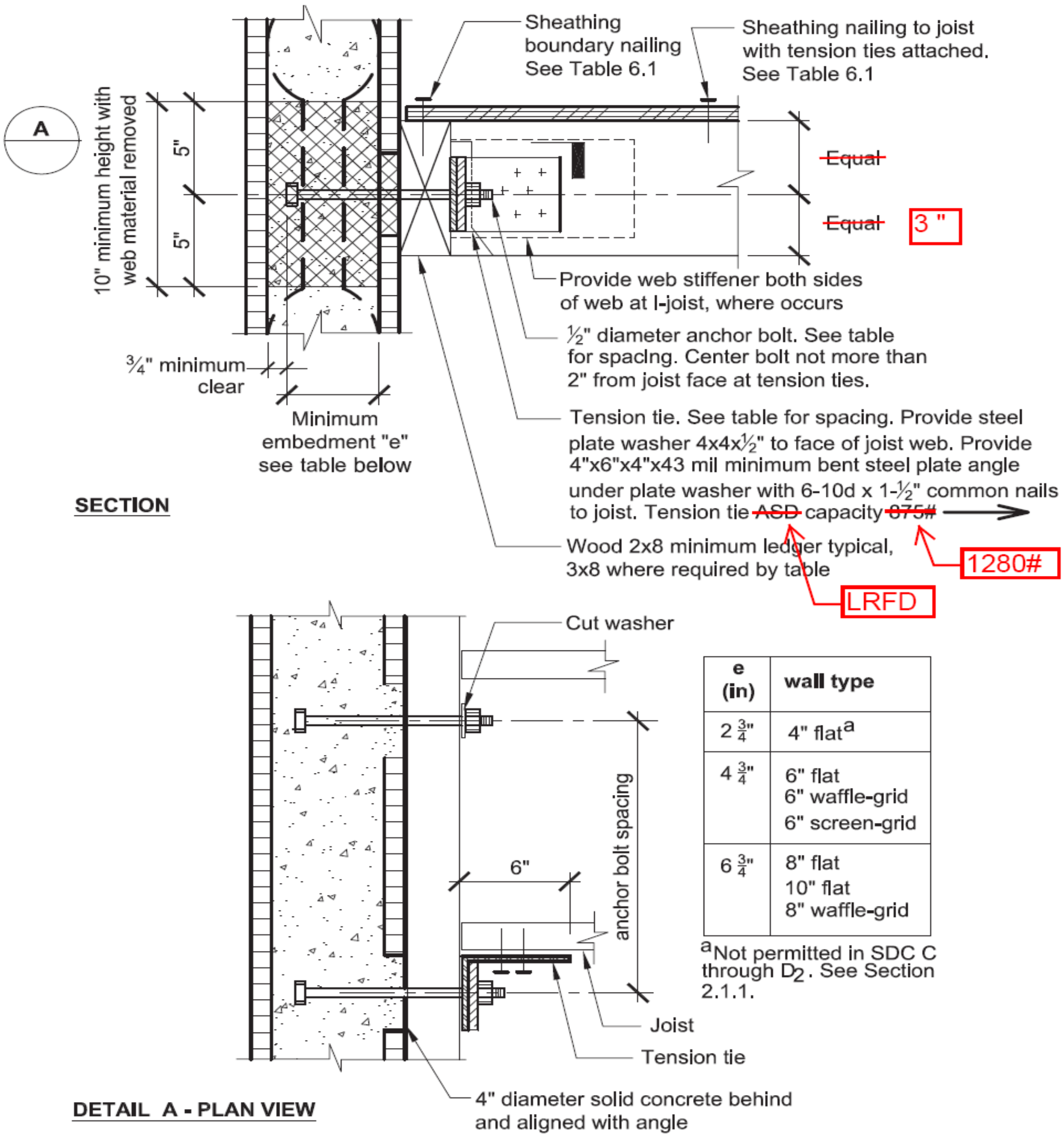
c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1, from Table R611.7(2). The reduced length shall not be less than the "minimum" value shown in the table.

d. Tabulated lengths for "one story or top story of two story" are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for "first story of two story" are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table R611.7(1A) , (1B) or (1C), or multiply the value in the table by the reduction factor, R_2, from Table R611.7(3).

e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3, from Table R611.7(4).

f. The reduction factors, R_1, R_2 and R_3, in Tables R611.7(2), R611.7(3), and R611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R611.7.1 and R611.7.2.1, respectively.

g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.



e (in)	wall type
2 ¾"	4" flat[a]
4 ¾"	6" flat 6" waffle-grid 6" screen-grid
6 ¾"	8" flat 10" flat 8" waffle-grid

[a]Not permitted in SDC C through D_2. See Section 2.1.1.

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R611.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

~~TABLE R611.9(1)~~
~~WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph)~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	~~A~~	~~A~~
~~16~~	~~32~~	-	-	-	-	-	-
~~16~~	~~48~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	~~A~~	~~A~~	~~A~~	~~A~~	~~A~~	-
~~19.2~~	~~38.4~~	~~A~~	~~A~~	~~A~~	-	-	-

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(1). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. Letter "A" indicates that a minimum nominal 3 × 8 ledger is required.~~

TABLE R611.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph)					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(1). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

FIGURE R611.9(2) WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL FRAMING PARALLEL

In Figure R611.9(2), in SECTION view note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~875#~~1280# →"

~~TABLE R611.9(2)~~
~~WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL~~[~~a, b~~]

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85b~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	-	-
~~16~~	~~32~~	-	-	-	-	-	-
~~16~~	~~48~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	-	-	-	-	-	-
~~19.2~~	~~38.4~~	-	-	-	-	-	-
~~24~~	~~24~~	-	-	-	-	-	-
~~24~~	~~48~~	-	-	-	-	-	-

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~
~~a. This table is for use with the detail in Figure R611.9(2). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.~~
~~b. Wall design per other provisions of Section R611 is required.~~

TABLE R611.9(2)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL[a, b]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						

19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(2). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

FIGURE R611.9(3) WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL FRAMING PERPENDICULAR

In Figure R611.9(3), in PLAN VIEW bottom note about tension tie, revise last sentence to read: "Tension tie ~~ASD~~LRFD capacity ~~760#~~1280# for both angles (~~380#~~640# per angle) →"

~~TABLE R611.9(3)~~
~~WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR~~~~[a, b, c, d, e]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	~~6 A~~	~~6 B~~
~~16~~	~~32~~	-	-	-	-	~~6 A~~	~~6 B~~
~~16~~	~~48~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	-	-	-	~~6 A~~	~~6 A~~	~~6 B~~
~~19.2~~	~~38.4~~	-	-	-	~~6 A~~	~~6 A~~	-
~~24~~	~~24~~	-	-	~~6 A~~	~~6 B~~	~~6 A~~	-
~~24~~	~~48~~	-	-	~~6 A~~	-	-	-

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(3). Use of this detail is permitted where cell is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions in Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(3). For the remainder of the wall, see Note b.~~

~~e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimal nominal 3 × 6 sill plate are required.~~

TABLE R611.9(3)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(3). Use of this detail is permitted where cell is not shaded, prohibited where shaded.

b. Wall design per other provisions in Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Numbers 6 and 8 indicate~~s~~ minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(3). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^{5}/_{8}$-inch-diameter anchor bolt and a minimal nominal 3 × 6 sill plate are required.

FIGURE R611.9(4) WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL FRAMING PARALLEL

In Figure R611.9(4), in PLAN VIEW note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~760#~~1280# for both angles (~~360#~~640# per angle) →"

~~**TABLE R611.9(4)**~~
~~**WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d, e]**~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
-	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-

~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	~~6 A~~	~~6 B~~
~~16~~	~~32~~	-	-	-	-	~~6 A~~	~~6 B~~
~~16~~	~~48~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	-	-	-	~~6 A~~	~~6 A~~	~~6 B~~
~~19.2~~	~~38.4~~	-	-	-	~~6 A~~	~~6 A~~	-
~~24~~	~~24~~	-	-	~~6 A~~	~~6 B~~	~~6 B~~	-
~~24~~	~~48~~	-	-	~~6 A~~	-	-	-

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(4). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(4). For the remainder of the wall, see Note b.~~

~~e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimal nominal 3 × 6 sill plate are required.~~

TABLE R611.9(4) WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(4). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Numbers 6 and 8 indicate~~s~~ minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(4). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimal nominal 3 × 6 sill plate are required.

FIGURE R611.9(5) COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

In Figure R611.9(5), in SECTION view note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~2010#~~3200# →"

~~TABLE R611.9(5)~~
~~COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR~~~~[a, b, c, d]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~12~~	~~36~~	-	-	-	-	-	~~6~~
~~12~~	~~48~~	-	-	-	-	~~6~~	~~6~~
~~16~~	~~16~~	-	-	-	-	-	-
~~16~~	~~32~~	-	-	-	-	-	-
~~16~~	~~48~~	-	-	-	-	~~6~~	~~6~~
~~19.2~~	~~19.2~~	-	-	-	-	-	-
~~19.2~~	~~38.4~~	-	-	-	-	-	~~6~~
~~24~~	~~24~~	-	-	-	-	-	-
~~24~~	~~48~~	-	-	-	-	~~6~~	~~6~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.4470 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(5). Use of this detail is permitted where a cell is not shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(5). For the remainder of the wall, see Note~~ b.

TABLE R611.9(5)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.4470 m/s.

a. This table is for use with the detail in Figure R611.9(5). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

FIGURE R611.9(6) COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL

In Figure R611.9(6), in SECTION view bottom note about tension tie, revise last sentence to read: "Tension tie ~~ASD~~LRFD capacity ~~2010#~~3200# →"

~~TABLE R611.9(6)~~
~~COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
				~~85C~~	~~90C~~	~~100C~~	~~110C~~
					~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~						
~~12~~	~~24~~						
~~12~~	~~36~~						~~6~~
~~12~~	~~48~~					~~6~~	~~6~~
~~16~~	~~16~~						
~~16~~	~~32~~						
~~16~~	~~48~~					~~6~~	~~6~~

~~19.2~~	~~19.2~~						
~~19.2~~	~~38.4~~						~~6~~
~~24~~	~~24~~						
~~24~~	~~48~~					~~6~~	~~6~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(6). Use of this detail is permitted where a cell is not shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thick ness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(6). For the remainder of the wall, see Note b.~~

TABLE R611.9(6)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL[a, b, c]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(6). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

FIGURE R611.9(7) COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL FRAMING PERPENDICULAR

In Figure R611.9(7), in PLAN VIEW note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~700#~~1280# →"

~~**TABLE R611.9(7)**~~
~~**COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]**~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~

		-	-	~~858C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	~~6 A~~	~~6 B~~
~~16~~	~~32~~	-	-	-	-	~~6 A~~	~~6 B~~
~~19.2~~	~~19.2~~	-	-	-	~~6 A~~	~~8 B~~	~~8 B~~
~~19.2~~	~~38.4~~	-	-	-	~~6 A~~	~~8 B~~	~~8 B~~
~~24~~	~~24~~	-	-	~~6 A~~	~~8 B~~	~~8 B~~	

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(7). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(7). For the remainder of the wall, see Note b.~~

~~e. Letter “A” indicates that a minimum nominal 3 × 6 sill plate is required. Letter “B” indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.~~

TABLE R611.9(7)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12	-	-	-	-	-	6
12	24	-	-	-	-	6	6
16	16	-	-	-	-	6	6 A
16	32	-	-	-	6	6	6A
19.2	19.2	-	-	-	6A	6A	6B
19.2	38.4	-	-	6	6A	6A	6B
24	24	-	-	6A	6B	6B	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(7). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(7). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^{5}/_{8}$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

FIGURE R611.9(8) COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL

In Figure R611.9(8), in PLAN VIEW note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~750#~~1280# →"

~~**TABLE R611.9(8)**~~
~~**COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL**~~ ~~a, b, c, d, e~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
				~~85C~~	~~90C~~	~~100C~~	~~110C~~
					~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~						
~~12~~	~~24~~						
~~16~~	~~16~~					~~6 A~~	~~6 B~~
~~16~~	~~32~~					~~6 A~~	~~6 B~~
~~19.2~~	~~19.2~~				~~6 A~~	~~8 B~~	~~8 B~~
~~19.2~~	~~38.4~~				~~6 A~~	~~8 B~~	~~8 B~~
~~24~~	~~24~~			~~6 A~~	~~8 B~~	~~8 B~~	

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(8). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(8). For the remainder of the wall, see Note b.~~

~~e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^{5}/_{8}$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.~~

TABLE R611.9(8)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL a, b, c, d, e

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12	-	-	-	-	-	6
12	24	-	-	-	-	6	6
16	16	-	-	-	-	6	6A

16	32	_	_	_	6	6	6A
19.2	19.2	_	_	_	6A	6A	6B
19.2	38.4	_	_	6	6A	6A	6B
24	24	_	_	6A	6B	6B	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(8). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(8). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^{5}/_{8}$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

FIGURE R611.9(9) WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

In Figure R611.9(9), in PLAN VIEW note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~760#~~1280# both angles, ~~360#~~640# per angle →"

~~TABLE R611.9(9)~~
~~WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR~~[a, b, c, d, e]

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	-	~~6~~
~~16~~	~~32~~	-	-	-	-	-	~~6~~
~~16~~	~~48~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	-	-	-	-	~~6~~	~~6~~ ~~A~~
~~19.2~~	~~38.4~~	-	-	-	-	~~6~~	-
~~24~~	~~24~~	-	-	-	~~6~~ ~~A~~	~~6~~ ~~A~~	~~6~~ ~~B~~
~~24~~	~~48~~	-	-	-	-	-	-

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(9). Use of this detail is permitted where cell a is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(9). For the remainder of the wall, see Note b.~~

~~e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.~~

TABLE R611.9(9) WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12	_	_	_	_	_	6
12	24	_	_	_	_	_	6
12	36	_	_	_	_	6	6
12	48	_	_	_	6	6	6
16	16	_	_	_	_	6	6
16	32	_	_	_	_	6	6
16	48	_	_	_	6	6	6
19.2	19.2	_	_	_	_	6	6
19.2	38.4	_	_	_	6	6	_
24	24	_	_	_	6		
24	48	_	_	6	8B	_	_

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(9). Use of this detail is permitted where cell a is not shaded, prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Numbers 6 and 8 indicate~~s~~ minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(9). For the remainder of the wall, see Note b.

e. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

FIGURE R611.9(10) WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL FRAMING PARALLEL

In Figure R611.9(10), in SECTION view note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~1340#~~2140# →"

~~TABLE R611.9(10)~~
~~WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d, e]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-

~~12~~	~~36~~	-	-	-	-	-	-
~~12~~	~~48~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	~~6~~	~~6~~
~~16~~	~~32~~	-	-	-	-	~~6~~	~~6~~
~~16~~	~~48~~	-	-	-	-	~~6~~	~~6~~
~~19.2~~	~~19.2~~	-	-	-	~~6~~	~~6~~	~~6~~ ~~A~~
~~19.2~~	~~38.4~~	-	-	-	~~6~~	~~6~~	~~6~~ ~~A~~
~~24~~	~~24~~	-	-	~~6~~	~~6~~ ~~A~~	~~6~~ ~~A~~	~~6~~ ~~B~~
~~24~~	~~48~~	-	-	~~6~~	~~6~~ ~~A~~	~~6~~ ~~B~~	~~6~~ ~~B~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(10). Use of this detail is permitted where a cell is not shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in cells with no number.~~

~~d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(10). For the remainder of the wall, see Note b.~~

~~e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.~~

TABLE R611.9(10) WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12						6
12	24						6
12	36					6	6
12	48				6	6	6
16	16					6	6
16	32					6	6
16	48				6	6	6
19.2	19.2					6	6
19.2	38.4				6	6	
24	24				6		
24	48			6	8B		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(10). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in cells with no number.

d. Numbers 6 and 8 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure

R611.9(10). For the remainder of the wall, see Note b.

e.. Letter "B" indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

FIGURE R611.9(11) COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

In Figure R611.9(11), in PLAN VIEW note about tension tie, revise last sentence to read:
"Tension tie ~~ASD~~LRFD capacity ~~700#~~1280# →"

~~TABLE R611.9(11)~~
~~WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]~~

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
				~~85C~~	~~90C~~	~~100C~~	~~110C~~
					~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~						
~~12~~	~~24~~						
~~16~~	~~16~~					~~6~~	~~6~~
~~16~~	~~32~~					~~6~~	~~6~~
~~19.2~~	~~19.2~~				~~6~~	~~6~~	~~8~~ ~~B~~
~~19.2~~	~~38.4~~				~~6~~	~~6~~	~~8~~ ~~B~~
~~24~~	~~24~~			~~6~~	~~6~~	~~8~~ ~~B~~	

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(11). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.~~

~~d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thick ness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(11). For the remainder of the wall, see Note b.~~

~~e. Letter "B" indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.~~

~~For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.~~

TABLE R611.9(11) WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR[a, b, c, d, e]

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
				110C	119C	127C	136C
					110D	117D	125D
12	12	_	_	_	_	_	6
12	24	_	_	_	_	_	6
16	16	_	_	_	_	6	6
16	32	_	_	_	_	6	6

19.2	19.2	_	_	_		6	6
19.2	38.4	_	_	_	6	6	6
24	24	_	_		6	6A	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(11). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells with no number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(11). For the remainder of the wall, see Note b.

e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.

FIGURE R611.9(12) COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL

In Figure R611.9(12), in SECTION view note about tension tie, revise last sentence to read: "Tension tie ~~ASD~~LRFD capacity ~~800#~~1600# →"

~~TABLE R611.9(12)~~
~~COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL~~[a, b, c, d, e]

~~ANCHOR BOLT SPACING (inches)~~	~~TENSION TIE SPACING (inches)~~	~~BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY~~					
		~~85B~~	~~90B~~	~~100B~~	~~110B~~	~~120B~~	~~130B~~
		-	-	~~85C~~	~~90C~~	~~100C~~	~~110C~~
		-	-	-	~~85D~~	~~90D~~	~~100D~~
~~12~~	~~12~~	-	-	-	-	-	-
~~12~~	~~24~~	-	-	-	-	-	-
~~16~~	~~16~~	-	-	-	-	-	-
~~16~~	~~32~~	-	-	-	-	-	-
~~19.2~~	~~19.2~~	-	-	-	-	~~6~~	~~6~~
~~19.2~~	~~38.4~~	-	-	-	-	~~6~~	~~6~~
~~24~~	~~24~~	-	-	~~6~~	~~6~~	~~8 B~~	~~8 B~~

~~For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.~~

~~a. This table is for use with the detail in Figure R611.9(12). Use of this detail is permitted where a cell is not shaded.~~

~~b. Wall design per other provisions of Section R611 is required.~~

~~c. For wind design, minimum 4-inch-nominal wall is permitted in cells with no number.~~

~~d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(12). For the remainder of the wall, see Note b.~~

~~e. Letter "B" indicates that a 5/8-inch-diameter anchor bolt is required.~~

TABLE R611.9(12) COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL[a, b, c, d, e]

ANCHOR BOLT	TENSION TIE	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B

SPACING (inches)	SPACING (inches)			110C	119C	127C	136C
					110D	117D	125D
12	12	_	_	_	_	_	6
12	24	_	_	_	_	_	6
16	16	_	_	_	_	6	6
16	32	_	_	_	_	6	6
19.2	19.2	_	_	_		6	6
19.2	38.4	_	_	_	6	6	6
24	24	_	_		6	6	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R611.9(12). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section R611 is required.

c. For wind design, minimum 4-inch-nominal wall is permitted in cells with no number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure R611.9(12). For the remainder of the wall, see Note b.

e. Letter "B" indicates that a $^5/_8$-inch-diameter anchor bolt is required.

R611.9.2 Connections between concrete walls and light-framed floor systems. Connections between concrete walls and light-framed floor systems shall be in accordance with one of the following:

1. For floor systems of wood frame construction, the provisions of Section R611.9.1 and the prescriptive details of Figures R611.9(1) through R611.9(4), where permitted by the tables accompanying those figures. Portions of connections of wood-framed floor systems not noted in the figures shall be in accordance with Section R502, or AF&PA/WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. For floor systems of cold-formed steel construction, the provisions of Section R611.9.1 and the prescriptive details of Figures R611.9(5) through R611.9(8), where permitted by the tables accompanying those figures. Portions of connections of cold-formed-steel framed floor systems not noted in the figures shall be in accordance with Section R505, or AISI S230, if applicable.
3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AF&PA/NDS for wood frame construction or AISI S100 for cold-formed steel frame construction.

R611.9.3 Connections between concrete walls and light-framed ceiling and roof systems. Connections between concrete walls and light-framed ceiling and roof systems shall be in accordance with one of the following:

1. For ceiling and roof systems of wood frame construction, the provisions of Section R611.9.1 and the prescriptive details of Figures R611.9(9) and R611.9(10), where permitted by the tables accompanying those figures. Portions of connections of wood-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R802, or AF&PA/WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. For ceiling and roof systems of cold-formed-steel construction, the provisions of Section R611.9.1 and the prescriptive details of Figures R611.9(11) and R611.9(12), where permitted by the tables accompanying those figures. Portions of connections of cold-formed-steel

framed ceiling and roof systems not noted in the figures shall be in accordance with Section R804, or AISI S230, if applicable.

3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AF&PA/NDS for wood-frame construction or AISI S100 for cold-formed-steel frame construction.

R611.10 Floor, roof and ceiling diaphragms. Floors and roofs in all buildings with exterior walls of concrete shall be designed and constructed as *diaphragms.* Where gable-end walls occur, ceilings shall also be designed and constructed as *diaphragms*. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as *diaphragms* shall comply with the applicable requirements of this code, or AF&PA/WFCM or AISI S230, if applicable. <u>Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.</u>

Reason: Background. The provisions currently in Section R611 are based on *PCA 100-2007, Prescriptive Design of Exterior Concrete Walls for One- and Two-Family Dwellings* (PCA 100). The provisions of PCA 100-2007 are based on ACI 318-05 and ASCE 7-05, and the 2006 IBC. Recently the 2012 edition of PCA 100 was issued which is based on ACI 318-11, ASCE 7-10, and the 2012 IBC. Therefore, the purpose of this code change is to update the code's provisions to agree with PCA 100-2012; therefore, to agree with ACI 318-11, ASCE 7-10, and the 2012 IBC.

A significant change was made to the wind load provisions of ASCE 7-10 involving the basis wind speed map. Prior to the 2010 edition of ASCE 7, its wind load provisions yielded service-level design wind pressures, which were used to compute loads for use in the various load combinations. For strength design (LRFD), the computed loads were multiplied by a load factor that generally was 1.6. Over the past 20 years, seismic design provisions of ASCE 7 have been based on strength level loads, with the load factor for strength design being 1.0. Because there was a desire within the engineering community to convert the wind load provisions to strength-level forces, which would then be multiplied by a load factor of 1.0, ASCE 7-10 was revised with this in mind.

In order to reduce the load factor on wind for strength design from 1.6 to 1.0, the basic wind speeds were increased. Since wind pressure varies as the square of the wind velocity, wind speeds were increased by the square root of 1.6, which is 1.265. Computed velocities were rounded to the nearest 5 mph for areas away from the hurricane coast lines of the Atlantic Ocean and Gulf of Mexico. For example, under ASCE 7-05 for an occupancy category ("risk category" under ASCE 7-10) II structure (with an Importance Factor of 1.0), the basic wind speed was 90 mph away from the coast line. Under the new map of Figure 26.5-1A of ASCE 7-10 for Risk Category II structures, the basic wind speed away from the coast line is 115 mph (90 x 1.265 = 113.85, which was rounded to 115). Also, two additional (2) maps were created for ASCE 7-10 (Figures 26.5-1B and 26.5-1C), which allow the old wind importance factor to be abandoned. All three maps reflect revisions to basic wind speeds based on analysis of newer wind-speed data for areas near the Atlantic Ocean and Gulf of Mexico. Generally speaking, for areas away from the hurricane coast lines, wind loads calculated utilizing strength design procedures will be approximately the same under ASCE 7-10 as under ASCE 7-05. For most areas near the hurricane coast lines, wind loads under ASCE 7-10 will be somewhat less than under ASCE 7-05.

Because of the changes to basic wind speeds in ASCE 7-10, the provisions of PCA 100-2007, which are based on ASSCE 7-05, had to be revised. The grouping of basic wind speeds over the three exposure categories shown in the proposed changes to the various tables was accomplished as follows. Since most one- and two-family dwellings are constructed in exposure category B, the velocity pressures, ***q***, were calculated for a building with a mean roof height, ***h***, of 35 feet based on exposure category B, for basic wind speeds of 115, 120, 130, 140, 150 and 160 mph. Using those velocity pressures, the basic wind speeds were calculated that would result in the same velocity pressures for exposure categories C and D. For example, a basic wind speed of 160 mph in exposure B for a 35-foot high building will give the same velocity pressure as 136 mph and 125 mph in exposures C and D, respectively. These velocities and corresponding exposure categories are the limits of application of these provisions. The proposed upper limits on velocities result in design pressures that are similar to those in the existing code when considering that the load factor for strength design has been reduced from 1.6 to 1.0.

It will be noted in the proposal that the lowest tabulated wind speed for exposure B is 115 mph; whereas, the basic wind speed for California and the Pacific northwest is 110 mph. To accommodate 110 mph, it would have been necessary to expand the tables, which was not desirable. In addition, a review of the various tables will show that generally it does not make any difference since the solution for 115 mph, exposure B, is the minimum acceptable one. Also, where most construction is taking place in the area with the 110 mph basic wind speed, dwellings will be Seismic Design Category D, which these provisions do not cover.

Part 1 - Section R611.2 – See **background** reason.

Part 2 - Section R611.6 - The primary reason changes have been made to this section is due to the change in basis of the basic wind speeds of ASCE 7-10 which were discussed in the **background** reason for the change.

In addition, the existing tables are based on ACI 318-05; therefore, they are being updated to ACI 318-11. One change to ACI 318 made between the 2005 and 2011 editions increased the strength reduction factor, ***ø***, for plain concrete from 0.55 to 0.60. Everything else remaining equal, this resulted in an increase of 9% in design strength. This change resulted in more conditions (i.e., cells) where plain concrete is acceptable (i.e., #4 bars at 48 inches on center).

Other changes are essentially editorial in nature and are intended to clarify and facilitate use of the provisions. Some of these include:

1. Adding text to Section R611.6.2 and some table notes to clarify how to use the table for non-loadbearing walls, and
2. Shading of cells which signifies that plain concrete is permitted (note that some reinforcement is still required in the form of #4 bars at 48 inches on center).

Part 3 - Section R611.7 - The primary reason changes have been made to this section is due to the change in basic wind speeds of ASCE 7-10 which were discussed in the **background** reason for the change.

In addition, under ASCE 7-05 and earlier editions, the main wind-force resisting system of an enclosed or partially enclosed building had to be designed for a minimum load of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Applying these loads resulted in the unreduced length of solid wall shown under the “minimum” column of the existing tables. ASCE 7-10 changed this provision in two ways. Because of the switch to strength-based wind loads, 10 psf was multiplied by the former strength load factor, 1.6. This resulted in the status quo since the load factor on wind is now 1.0. However, a signification change was made to the load to be applied to the roof portion of the building that is projected onto the vertical plane. That load was reduced 50% from 16 to 8 psf. This change is reflected in the proposed tables by lower minimum values, and fewer shaded cells which alert the user that the minimum value governs.

Other changes are either editorial in nature, to correlate with the new changes in ASCE 7-10, or correct errors and omissions in the existing provisions.

Part 4 - Section R611.9 - The primary reason changes have been made to this section is due to the change in basic wind speeds of ASCE 7-10 which were discussed in the **background** reason for the change. Other reasons follow.

ASCE 7-10 Figure 28.4-1 includes a revised description of Load Case B governing wind blowing generally parallel to the ridge of a building. In some cases this redefined load case created controlling loads and thus required revisions to PCA 100 and the IRC.

Consistent with Table 1.1 of PCA 100 and IRC Table R301.5, the second floor live load was reduced from 40 psf to 30 psf based on sleeping rooms.

Also, consistent with the change to strength (LRFD) level wind loads, LRFD capacity calculations were used, in some cases affecting tabulated locations where details are applicable.

Part 5 - Sections R611.9.2 and R611.9.3 – Design of connections involving wood framing members requires that certain mechanical properties of the wood be known. Many mechanical properties of wood used by the structural engineer are related to the specific gravity (or density) of the wood. This property can vary widely depending upon the species of the wood. Therefore, in order to simplify the design of the prescriptive connection details in Section R611.9, it was decided that rather than have several groups of two of more wood species per group, a lower-bound value on the specific gravity would be used as the method of differentiating between species included in the scope of PCA 100-2012 and those requiring engineered design.

Part 6 - Section R611.10 - See reason for Part 5.

Cost Impact: The code change proposal will not increase the cost of construction.

RB334-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R611.2-RB-SZOKE.doc

RB335 – 13
R611.5.1

Proponent: Stephen S. Szoke, P.E., Portland Cement Association

Revise as follows:

R611.5.1 Concrete and materials for concrete. Materials used in concrete, and concrete itself, shall conform to the requirements of this section, PCA 100, or ACI 318.

Reason: There are three design methods permitted by the code. Design and construction may be in compliance with:

The criteria of Section R611 of the IRC which is based on transcription from the *PCA100 Standard Prescriptive Design of Exterior Concrete Walls for One- and Two-Family Dwellings*;

PCA100 Standard Prescriptive Design of Exterior Concrete Walls for One- and Two-Family Dwellings which includes design scenarios too voluminous to be transcribed into the IRC;

ACI 318 Building Code Requirements for Structural Concrete for structures not suitable for simplistic prescriptive design.

This change simply allows materials to comply with the requirements of PCA 100 where PCA 100 is used for the design of structures

Cost Impact: The code change proposal will not increase the cost of construction.

RB335-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R611.5.1-RB-SZOKE.doc

RB336 – 13
R611.5.1.1 (NEW), Chapter 44

Proponent: Stephen S. Szoke, P.E., Portland Cement Association/Portland Cement Association

Add new text as follows:

R611.5.1.1 Cements. The following standards as referenced in Chapter 44 shall be permitted to be used.

1. ASTM C 150
2. ASTM C 595
3. ASTM C 1157

Add new standard to Chapter 44 as follows:

ASTM

C1157 - 11 Standard Performance Specification for Hydraulic Cement

Reason: To update the specifications standards for Portland Cement, Blended Hydraulic Cement, and Hydraulic Cement referenced for use in concrete. Due to the change in the cycles for code and standards development referenced standards may not be referring the appropriate edition of standards for cement or even editions of standards that reflect cement that is available. Due to the rapid changes in the manufacturing processes due to both technological advancements and government rules and regulations, the requirements for cements are also changing more rapidly than can be accommodated by the code and referenced design standard processes. This change helps assure that cements complying with the most current edition of the standard specifications are used for construction. Without this modification and the potential to be referring an out-of-date standard specifications could result in requiring products that are no longer available. This change allows for cements with the appropriate restrictions on ingredients to be properly referenced in the IRC 2015. This change does not introduce new types of cement for use in concrete, but provides the mechanism to assure that the most recent, to the extent possible, product standard specifications are cited in the code. This change is consistent with a similar code change approved for the IBC.

Examples of the types of modifications may by ASTM International Committee C01 on Cements that need to accommodated in code development are as follows:

ASTM C150-12

Compared to ASTM C150-09 referenced in ACI 318-11, ASTM C150-12 includes revisions that:

1. Make the air permeability test the default method for determining compliance with specific surface fineness requirements and moves determination by the turbidimetric method to the optional table. This reflects industry practice.
2. Clarification on Type II (MH) moderate heat and moderate sulfate resistant cement heat index requirements, clarification on procedure for determining potential phase (Bogue) composition, and some additional minor improvements. No changes are made to the physical or chemical requirements of C150.

Additionally, compared to ASTM C150-07*a* referenced in IBC 2012 Chapter 35, ASTM C150-12 includes revisions to:

1. Distinguish between organic and inorganic processing additions and include a limit of 5% on inorganic processing additions and 1% on organic processing additions.
2. Modify procedures for determining potential phase composition to account for effect of inorganic processing additions in cement on potential phase composition calculations.
3. Include provisions for a Type II (MH) designation for moderate heat and moderate sulfate resistant cement.
4. Various other minor improvements. Again no changes were made to the physical or chemical requirements of C150 for portland cements.

The variations in product that will result from the use of C150-12 versus C150-07 will not adversely impact the performance of concrete with regard to compliance with ACI 318, PCA 100, or the provisions of the IRC.

C595-12

Compared to C595-09 referenced in ACI 318-11, ASTM C595-12 includes revisions to:

1. Include provisions for a new Type IL portland-limestone blended cement designation for cement containing from 5% to 15% limestone. C595 Type IL has same physical requirements as Type IP and IS (<70), which are also comparable to ASTM C150 physical requirements. Portland-limestone cement provides an alternative for improving the sustainability of concrete.
2. Several clarifications and improvements to the C595 provisions for Type IT ternary blended cements.

3. Clarifications and improvements to C595 naming practice used to identify amount slag, pozzolan or limestone contained in blended cements.

Additionally, compared to C595-08a referenced in IBC 2012 Chapter 35, ASTM C595-12 also includes provisions for Type IT ternary blended cement (cements containing portland cement with either a combination of two different pozzolans, or slag cement and a pozzolan, a pozzolan and a limestone, or a slag cement and a limestone). Ternary blended cements have the same physical requirements as Type IT and Type IS (<70) cements. Ternary blended cements were first introduced in the 2009 edition of ASTM C595.

The variations in product that will result from the use of C595-12 versus C595-08a will not adversely impact the performance of concrete with regard to compliance with ACI 318, PCA-100, or the provisions of the IRC.

ASTM C1157-11

Compared to C1157-09 referenced in ACI 318-11, ASTM C595-12 includes revisions to:

1. Include provisions for distinguishing between air entraining and non air-entraining C1157 cements with appropriate designations and limits consistent with those of ASTM C150 and C595 for air entraining and non air entraining cements.
2. A minor modification to correct the significant figures for minimum strength limits for SI unit values listed in Table 1.

The variations in product that will result from the use of C1157-12 versus C1157-09 will not adversely impact the performance of concrete with regard to compliance with ACI 318, PCA 100, or the provisions of the IRC.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, ASTM D 1157 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.
The update for ASTM C150-07 and ASTM C595-08a is in the ADM proposal which is heard by the Administrative Code Development Committee. The promulgator ASTM has proposed to update to ASTM C150-~~07~~ 12 and ASTM C595-~~08a~~ 12.

RB336-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R611.5.1.1 (NEW)-RB-SZOKE.doc

RB337 – 13
R612.1

Proponent: Jeff Inks, Window and Door Manufacturers Association

Revise as follows:

R612.1 General. This section prescribes performance and construction requirements for exterior windows and doors installed in walls. Windows and doors shall be installed ~~and flashed~~ in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section R703.8. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

Reason: The intent of this proposal is to clarify that flashing requirements for window and door assemblies are provided exclusively in Chapter 7, Section 703.8. The proposal also corrects conflicting language with 703.8 which expressly allows the use of flashing installation alternatives in addition to the window or door manufacturer's installation instructions when applicable.

In addition this proposal provides an editorial correction by making "door", "window", and "wall" in the first sentence plural.

Cost Impact: The code change will not increase the cost of construction.

RB337-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.1 #1-RB-INKS.doc

RB338 – 13
R612.1

Proponent: Jeff Inks, Window and Door Manufacturers Association

Revise as follows:

R612.1 General. This section prescribes performance and construction requirements for window<u>s</u> and door<u>s</u> installed in wall<u>s</u>. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's ~~written~~ <u>published</u> installation instructions. Window and door openings shall be flashed in accordance with Section R703.8. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

Reason: This proposals provides an editorial correction by making "door", "window", and "wall" in the first sentence plural and in addition replaces the term "written" with "published" given manufacturers provide installation instructions in both printed and electronic format which can also be printed by the user. The term "published" more clearly reflects how installation instructions are being provided by manufacturers.

Cost Impact: The code change will not increase the cost of construction.

RB338-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.1 #2-RB-INKS.doc

RB339 – 13
R612.1, R612.2, R612.3

Proponent: Julie Ruth/JRuth Code Consulting, representing American Architectural Manufacturers Association (julruth@aol.com)

Revise as follows:

R612.1 General. This section prescribes performance and construction requirements for exterior window and door assemblies installed in walls. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section R703.8. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

R612.2 Performance. Exterior window~~s~~ and door~~s~~ assemblies shall be designed to resist the design wind loads specified in Table R301.2(2) adjusted for height and exposure in accordance with Table R301.2(3).

R612.3 Testing and labeling. Exterior window~~s~~ and sliding door assemblies shall be tested by an *approved* independent laboratory, and bear a *label* identifying manufacturer, performance characteristics and *approved* inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged door assemblies shall be tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or comply with Section R612.5.

Reason: This proposal clarifies that the performance of the entire window or door assembly must be evaluated to determine compliance with the IRC. Window and door assemblies include the frame, hardware, weather stripping, thresholds, etc as well as the sash (window) or door slab (door). Only by evaluating the entire assembly can it be determined if the opening provides appropriate resistance to wind load, water penetration and air leakage.

Cost Impact: The code change proposal will not increase the cost of contruction.

RB339-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.1-RB-RUTH.doc

RB340 – 13
R612.3, Chapter 44

Proponent: Jessica Ferris, Association of Millwork Distributors (jferris@amdweb.com)

Revise as follows:

R612.3 Testing and labeling. Exterior windows and sliding doors shall be tested by an *approved* independent laboratory, and bear a *label* identifying manufacturer, performance characteristics and *approved* inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 <u>or AMD 100</u>, or comply with Section R612.5.

Add new standard to Chapter 44 as follows:

<u>AMD</u> **<u>Association of Millwork Distributors</u>**
<u>10047 Robert Trent Jones Parkway</u>
<u>New Port Richey, FL 34655-4649</u>

<u>AMD 100 - Structural Performance Rating of Side-Hinged Exterior Door Systems and Procedures for Component Substitution</u>

Reason: The purpose of this proposed code change is to add a new standard to this section of the code, which provides manufacturers of side-hinged exterior doors the option to certify to a structural standard that includes procedures for component substitution.

Incorporating reference to the AMD 100 standard in Section 612.3 will provide producers of side-hinged exterior door systems (SHEDS) with an acceptable alternative method for testing and labeling structural performance requirements. AMD 100 allows for the interchange or substitution of components while maintaining a structurally rated system, which eases the burden of having to test each door configuration assembled for the marketplace. Like AAMA/WDMA/CSA 101/I.S.2/A440, AMD 100 utilizes the ASTM E330 test method for obtaining design pressure ratings of SHEDS.

SHEDS have requirements that are quite different from exterior windows and sliding doors, and as such, have different considerations. The door industry is comprised of not only manufacturers but also smaller distributor and pre-hanger companies, dealers, and builders that purchase their door components from multiple suppliers and interchange these components in their systems regularly depending on customer needs. AMD 100 upgrades SHEDS without negatively affecting this supply chain.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, AMD 100 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB340-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.3-RB-FERRIS.doc

RB341 – 13
R612.3

Proponent: Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (julruth@aol.com)

Revise as follows:

R612.3 Testing and labeling. Exterior windows and ~~sliding~~ doors shall be tested by an *approved* independent laboratory, and bear a *label* identifying manufacturer, performance characteristics and *approved* inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. ~~Exterior side-hinged doors shall be tested and *labeled* as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or comply with Section R612.5.~~

Exceptions:

1. Decorative glazed openings.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

OH ratio = OH length/OH height

Where:

OH length = The horizontal measure of how far an overhang over the door projects out from the door's surface.
OH height = The measure of the distance from the door's sill to the bottom of the overhang over the door.

The required width of the overhang projection shall be as determined below:

W > (1.0 * Door width) + (2.0 * OH length)

Where:

W = Width of projection

3. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration need not be tested for water infiltration.

4. Doors that comply with Section R612.4.

Reason: The requirements for the residential building envelope have vastly improved over the course of the last 20 years. This proposal seeks to address one of the remaining weak elements in the building envelope for homes built under the IRC. This weak element is exterior swinging doors.

The integrity of the building envelope is critical to the health and life safety of the home's occupants. This is true not only during and after extreme wind and rain events, but also over the course of the building envelope's exposure to typical weather during the service life of the home. It is vitally important that all components of the building envelope perform at least 2 functions well. The first is resistance to the structural loads imposed by the wind. The second is resistance to wind driven rain.

A number of entries on the website of The Institute for Building and Home Safety (IBHS) emphasize the need to preserve the integrity of openings such as doors in the building envelope. These include:

- "The roof, windows and all doors in your home or business are the most vulnerable to damage when hurricane-force winds and rains pummel an area."
- "Once an opening is created, air rushes inside the structure and pressurizes it like inflating a balloon. The internal pressures build up and put pressure on ceilings and the roof, which is also getting uplift pressures from external wind forces. If the connections between the roof and walls are weak, these wind forces will drive the roof and walls to give way. Once the roof blows off the entire structure can collapse within seconds."

- “Don’t open your windows. You won’t save the house, as once thought and you will put yourself at risk of injury from breaking glass. You also may actually make things worse by giving wind and rain a greater chance of getting inside.”
- Older entry doors and particularly double doors and garage doors may be weak points where wind pressures and wind borne debris may force them open or push them out of their tracks. Glass windows, glass in doors and sliding glass doors are susceptible to failures from both pressure and wind borne debris impact. When any of these openings are breached, wind and water can enter your home and completely ruin the inside.
- In older homes, which are not well connected from top to bottom, the failure of a large window or a door can allow enough wind pressure to build up in your home that it almost doubles the effects of the winds howling around the outside. This can lead to significant structural failures.

Although the IBHS postings focus upon the need to maintain the structural integrity of all openings in the building envelope under extreme wind and rain events, penetration of wind driven rain through openings in the building envelope can have long term effects on the overall health of the home’s occupants. As observed by the American Lung Association:

- “Areas with this high level humidity and moist materials provide an ideal environment for the growth of microorganisms, which could result in continued or additional health hazards such as allergic reactions”.
- “Exposure to these microorganisms may increase the risk of developing lung disease. Damp buildings and furnishings promote the growth of microorganisms, cockroaches and mold, which can aggravate asthma and allergies and may cause the development of asthma, wheeze, cough and hypersensitivity pneumonitis in susceptible persons.”
- “Long-term high levels of humidity can foster growth of dust mites, which can cause asthma and trigger allergic reactions and asthma attacks. “

Documents posted in the IBHS website specifically refer to the International Building Code (IBC) and International Residential Code (IRC), developed by the International Code Council, as guides for building wind-resistant structures.

The IRC and IBC have required exterior windows and sliding doors to be tested and labeled to AAMA/WDMA/CSA 101/I.S.2/A440 since the first edition of both codes in 2000. In more recent editions garage doors have been required to be tested either in accordance with ASTM E330 or ANSI/DASMA 108. It seems likely that the reference to older doors and windows quoted above from the IBHS website refer to products installed before these criteria were put in place and widely enforced across the U.S.

Although other exterior doors, including swinging doors, are required by Section R612.5 to be tested for resistance to structural load in accordance with ASTM E330, the code official often does not have the resources needed to verify that the appropriate testing has occurred. If these doors were required to be tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 then the code official would only need to verify the presence of the appropriate label on the door during field inspection. Since the standard also addresses the water penetration and air infiltration resistance of the door, along with other characteristics, the overall performance of the building envelope is improved by installing fenestration products that comply with it. Hence, the code official or field inspector could significantly improve the safety and performance of the home through a relatively simple inspection step rather than undertaking the more arduous task of reviewing an ASTM E330 test report simply to verify structural performance.

Previous proposals to require swinging doors to be tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 were opposed on the basis that in many cases exterior doors are sheltered from the wind and rain, and therefore it is not necessary for them to protect the integrity of the building envelope to the same extent that is required for windows. This proposal recognizes that residential entry doors are often sheltered by a roof, awning or other type of overhang to protect building occupants who are waiting to enter the home from wind, rain and snow by including an exception for doors with overhang protection. The dimensions proposed are based upon current provisions of the 2010 Florida Building Code. Exceptions are also offered for doors that open to a nonhabitable area where water infiltration is acceptable, such as a swinging garage door, and overhead garage doors that comply with Section R612.4.

The IRC committee is urged to address this last weak element of the residential building envelope by approving this code change proposal.

Cost Impact: The code change proposal will not increase the cost of construction. The additional cost of testing and labeling exterior swinging doors in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 instead of testing each door assembly provided in accordance with ASTM E330, is none.

RB341-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.3-RB-RUTH.doc

RB342 – 13
R612.3.1, R612.5.1 (New)

Proponent: Julie Ruth, P.E., JRuth Code Consulting, representing American Architectural Manufacturers Association (julruth@aol.com)

Revise as follows:

R612.3.1 Comparative Analysis. Structural wind load design pressures for window and door units ~~smaller~~ other than the size tested in accordance with Section R612.3 shall be permitted to be different ~~higher~~ than the design value of the tested unit provided such different ~~higher~~ pressures are determined by accepted engineering analysis that is signed and sealed by a registered design professional. All components of the other ~~small~~ unit shall be the same as those of the tested unit. ~~Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.~~ Windows and doors rated in this manner shall comply with the following:

1. The frame area of the alternate size unit shall not exceed the frame area of the tested unit .
2. The alternate size unit shall vary from the tested unit only in width, height or load requirements.
3. The air and water infiltration resistance rating of the alternate size unit shall not exceed the air and water infiltration resistance rating of the tested unit.
4. The maximum cyclic pressure rating of the alternate size unit shall not exceed the maximum cyclic pressure rating of the tested unit when tested per ASTM E 1886 and ASTM E 1996, where applicable.

R612.5.1 Comparative Analysis. Structural wind load design pressures for window and door units other than the size tested in accordance with Section R612.3 shall be permitted to be different than the design value of the tested unit provided such different pressures are determined by accepted engineering analysis that is signed and sealed by a registered design professional. All components of the other unit shall be the same as those of the tested unit and the glass shall comply with Section R308.5. Windows and doors rated in this manner shall comply with the following:

1. The frame area of the alternate size unit shall not exceed the frame area of the tested unit.
2. The alternate size unit shall vary from the tested unit only in width, height or load requirements.
3. The maximum cyclic pressure rating of the alternate size unit shall not exceed the maximum cyclic pressure rating of the tested unit when tested per ASTM E 1886 and ASTM E 1996, where applicable.

Reason: Section R612.3 requires exterior windows and sliding doors to be tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 – 11. This specification establishes criteria for various performance classes and design pressure ratings for windows, doors and unit skylights. The manufacturer of the product chooses the performance class and design pressure rating for which they would like to demonstrate compliance. The size and width of the test specimen is then dictated by the largest size and width for which the manufacturer wishes to demonstrate compliance for that particular class and design pressure rating.

As an example, a manufacturer may have a product line of vertical sliding windows that they would like to have designated as performance class R, with a design pressure rating of 30 psf. If they would like to demonstrate compliance with AAMA/WDMA/CSA 101/I.S.2/A440 for windows up to 3 feet wide and 5 feet high, then the test specimen must be a minimum of 3 feet wide and 5 feet high. If the test specimen passes all the test criteria for an R Vertical Sliding Window with a DP 30 rating, than that rating can also be applied to any other windows in that same product line (i.e. same framing material and profile, same glass package, etc) that are smaller than the test specimen.

At some point a smaller window will be able to sustain a higher design pressure. This is true because the framing and glass are spanning shorter distances than they were for the test specimen. The current comparative analysis provisions in Section R612.5 recognize this phenomenon and establish criteria for its application to the rating of smaller window units. A higher design pressure rating can be assigned to a smaller window unit when all of its components (framing, glass package, etc) are identical to the tested unit. Since air infiltration resistance and water penetration resistance are tied to Performance Grade rating in AAMA/WDMA/CSA 101/I.S.2/A440, and this characteristic cannot be determined by calculations, the current provisions also require that the unit to receive the highest design pressure rating is also to be fully tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

In summary, the provisions require that the largest unit be tested to the design pressure rating desired, the smallest unit tested to the highest design pressure rating desired, and then, by interpolation though accepted engineering analysis, the appropriate rating for other sizes can be determined.

There have been some questions, however, from code officials, designers and product approval agencies with regards to how this particular section is to be applied. This proposal seeks to clarify the application of the section. By limiting the air leakage and water penetration resistance ratings of the smaller unit, it also eliminates the need for testing of the smaller unit, even if it is rated to a higher design pressure.

Specifically, this proposal:

1. Clarifies that the provisions are only to be applied to a unit whose frame area does not exceed that of the tested unit. Some confusion has existed as to whether a window unit that is, for example, shorter and wider, would be considered smaller or larger than the tested unit.
2. Maintains the criteria that all of the components of the alternate size unit are to be identical to those of the tested unit, and are to vary only in terms of width, height or load.
3. Limits the air infiltration resistance rating and water penetration resistance rating of the alternate size unit to that of the tested unit. Section R612.5.1 only permits the alternative size unit to be rated to a different structural design wind load pressure. If it is desired to have a unit rated to a higher Performance Grade rating (which includes resistance to air infiltration and water penetration as well as structural load and other associated performance requirements of AAMA/WDMA/CSA 101/I.S.2/A440) then testing of the alternate size unit would be required.
4. Limits the cyclical pressure rating of the alternate size unit, if applicable, to that of the tested unit. This criteria only applies to windows which have been tested as protected openings for resistance to impact by wind borne debris.
5. Expands the current comparative analysis provisions of Section R612.5 to windows and doors that are evaluated for resistance to structural load only under Section R612.5. Section R612.5 applies to exterior windows and door assemblies that are not within Section R612.3, such as site built windows, swinging doors and sloped glazing assemblies other than unit skylights.

We believe that adding these provisions to the IRC will ease the use of this section and result in a more uniform application of it.

Cost Impact: The code change proposal will not increase the cost of construction.

RB342-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.3.1-RB-RUTH.doc

RB343 – 13
R612.3.1, Chapter 44

Proponent: Jeff Inks, Window and Door Manufacturers Association

Revise as follows:

R612.3.1 Comparative analysis. Structural wind load design pressures for window and door units different than the size tested in accordance with Section R612.3 shall be permitted to be different than the design value of the tested unit when determined in accordance with one of the following comparative analysis methods:

1. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section R612.3 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.

2. In accordance with WDMA I.S. 11.

Add new standard to Chapter 44 as follows:

WDMA

I.S. 11-13 Industry Standard for Analytical Method for Design Pressure (DP) Ratings of Fenestration Products.

Reason: Comparative analysis based on accepted engineering methods provides a proven, accurate and reliable means for determining design pressures of different sized products within a fenestration product line based on testing of specimen unit/s from the respective line. This alleviates the need for costly testing of all sizes within the line saving considerable construction costs and providing greater design flexibility without incurring additional time and costs, especially for specialty/custom products, for testing that isn't necessary in order to determine the correct DP.

While the current provision has been and continues to be widely utilized for the reasons stated above, it is limited only to allowing comparative analysis for units smaller than the unit tested, not larger. However, as indicated above, comparative analysis can also be effectively used to accurately determine DP ratings for fenestration products that are larger in width and/or height than the actual tested specimen provided proper analytical methods are followed. In that case, comparative analysis for determining DP of units larger than tested unit should also be permitted by the IRC for that purpose as long as proper engineering analysis is required.

The intent of this proposal is to provide for that by allowing for comparative analysis to also be used on units larger than the tested unit if determined in accordance with WDMA I.S. 11. Method #1 above is the existing language without change and remains limited to units that are smaller which is appropriate. Proposed method #2, WDMA I.S. 11 - *Industry Standard for Analytical Method for Design Pressure (DP) Ratings of Fenestration Products*, provides more comprehensive alternative methods appropriate for using comparative analysis to determine DP of units different in size, both smaller and larger, than that of the tested unit/s within a product line The comparative analysis methods included in WDMA I.S. 11 are based on accepted engineering analysis which must also be sealed by a licensed Professional Engineer (PE) making it technically sound for use in the IRC for this purpose.

Copies of the standard are being submitted to ICC for ICC and IRC code committee review accordingly. The standard is also available on WDMA's website via the following link: https://www.wdma.com/OnlineBookstore/tabid/61/pid/20/WDMA-I-S-11-09-Voluntary-Analytical-Method-for-Design-Pressure-Rating-of-Fenestration-Products-PDF-Download.aspx

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, WDMA I.S with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB343-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R612.3.1-RB-INKS.doc

RB344 – 13
Table R613.5(1)

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

TABLE R613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ROOF ONLY (inches)[a]

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479. kPa.

N/A = Not applicable.

a. Design assumptions:
~~Deflection criteria: *L/*240~~
~~Roof load: 7 psf.~~
~~Ceiling load: 5 psf.~~
~~Wind loads based on Table R301.2(2).~~
~~Strength axis of facing materials applied vertically~~.
Maximum deflection criteria: L/240.
Maximum roof dead load: 10 psf.
Maximum roof live load: 70 psf.
Maximum ceiling dead load: 5 psf.
Maximum ceiling live load: 20 psf.
Wind loads based on Table R301.2 (2).
Strength axis of facing material applied vertically.
N/A indicates not applicable.

(Portions of Table not shown remain unchanged)

TABLE R613.5(2)
MINIMUM THICKNESS FOR SIP WALSL SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF (inches)[a]

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479. kPa.

N/A = Not applicable.

a. Design assumptions:
~~Deflection criteria: *L/*240~~
~~Roof load: 7 psf.~~
~~Ceiling load: 5 psf.~~
~~Second floor live load: 30 psf.~~
~~Second floor dead load: 10 psf.~~
~~Second floor dead load from walls: 10 psf.~~
~~Wind loads based on Table R301.2(2).~~
~~Strength axis of facing materials applied vertically~~.
Maximum deflection criteria: L/240.
Maximum roof dead load: 10 psf.
Maximum roof live load: 70 psf.
Maximum ceiling dead load: 5 psf.
Maximum ceiling live load: 20 psf.
Maximum second floor dead load: 10 psf.
Maximum second floor live load: 30 psf.
Maximum second floor dead load from walls: 10 psf.
Maximum first floor dead load: 10 psf.
Maximum first floor live load: 40 psf.
Wind loads based on Table R301.2 (2).
Strength axis of facing material applied vertically.
N/A indicates not applicable.

(Portions of Table not shown remain unchanged)

Reason: This change proposal corrects an error in the 2012 IRC. In the 2007-2008 code cycle with Code Change Proposal RB 178-07/08, the footnotes in Tables R613.5(1) and (2) were changed to the above footnotes with the exception of the phrase. "Strength axis of facing material applied vertically." This phrase was added in the 2009-2010 code cycle with code change proposal RB 129-09/10. Unfortunately when the underlined phrase was added, the rest of the footnotes were returned to the 2006 format. This is the fault of the submitter in that at the time RB 129-09/10 was written, the 2009 IRC had not been published. As a result the phrase "<u>Strength axis of facing material applied vertically</u>" was added to the footnotes of the then current 2006 IRC. When the 2009 IRC was made available, the submitter forgot to go back and change to the updated footnotes. Please note that only the phrase above was underlined in change RB 129-09/10.

Cost Impact: The code change proposal will not increase the cost of construction.

RB344-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R613.5(1)T-RB-KEITH.doc

RB345 – 13
R613.7

Proponent: Edward L. Keith, APA – The Engineered Wood Association (ed.keith@apawood.org)

Revise as follows:

R613.7 Drilling and notching. The maximum vertical chase penetration in SIPs shall have a maximum side dimension of 2 inches (51 mm) centered in the panel. Vertical chases shall have a minimum spacing of 24-inches (610 mm) on center. Maximum of two horizontal chases shall be permitted in each wall panel - one at 14 inches (360 mm) plus or minus 2 inches (51 mm) from the bottom of the panel and one ~~at mid-height of the wall panel~~ ~~core~~ at 48 inches (1 220 mm) plus or minus 2 inches (51 mm) from the bottom edge of the SIPs panel. The maximum allowable penetration size in a wall panel shall be as shown on the manufacturer's shop drawings circular or rectangular with a maximum dimension of 12 inches (300 mm). Overcutting of holes in facing panels shall not be permitted.

Reason: The initial wording was written based on an 8-ft tall wall. As Section R613 permits up to 10-ft tall walls, the horizontal chases, which are used for switch-box wiring, need to be properly placed at 48 inches from the bottom edge of the SIPs panel. A plus or minus tolerance was placed on the dimension to ease use in the field.

Cost Impact: The code change proposal will not increase the cost of construction.

RB345-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R613.7 #1-RB-KEITH.doc

RB346 – 13
R613.7

Proponent: Edward L. Keith, APA – The Engineered Wood Association/Structural Insulated Panel Association (ed.keith@apawood.org)

Revise as follows:

R613.7 Drilling and notching. The maximum vertical chase penetration in SIPs shall have a maximum side dimension of 2 inches (51 mm) centered in the panel core. Vertical chases shall have a minimum spacing of 24-inches (610 mm) on center. Maximum of two horizontal chases shall be permitted in each wall panel - one at 14 inches (360 mm) from the bottom of the panel and one at mid-height of the wall panel. ~~The maximum allowable penetration size in a wall panel shall be circular or rectangular with a maximum dimension of 12 inches (300 mm). Overcutting of holes in facing panels shall not be permitted.~~ <u>Additional penetrations are permitted where justified by analysis.</u>

Reason: This proposal takes extraneous information out of the IRC. The portion proposed for removal relates to information that must be provided by the panel manufacturer as it is only by considering the specific loads and structural geometry that such recommendation can be made. Simply providing a maximum hole size prescriptively is worthless if there is not an accompanying limitation on how many may be permitted in a given wall length. We have been unable to get such a limitation placed in the IRC for the last two cycles. Without such a limitation it is prudent to eliminate the maximum hole size provision as having the provision without limits can lead to potentially unsafe applications, while permitting additional penetrations where justified by analysis.

Cost Impact: The code change proposal will not increase the cost of construction.

RB346-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R613.7 #2-RB-KEITH.doc

RB347 – 13

R613.3.1, R613.3.7 (NEW), Figure R613.5(1), Table R613.5(1), Figure R613.5(2), Table R613.5(2), Figure R613.5(3), Figure R613.5(4), Figure R613.5(5), R613.5.3 (NEW), R613.5.4 (NEW), Figure R613.5.1, Figure R613.5.2, Figure R613.8, R613.8, R613.9, Figure R613.9, R613.10, Table R613.10, R613.10.1

Proponent: Stephen Kerr S.E., Josephson Werdowatz and Associates, Inc., representing self

Revise as follows:

R613.3.1 Core. The core material shall be composed of foam plastic insulation meeting one of the following requirements:

1. <u>Expanded Polystyrene (EPS) in accordance with</u> ASTM C 578 and have a minimum density of 0.90 pounds per cubic feet (14.4 kg/m^3); or
<u>2 Extruded polystyrene (XPS) in accordance with ASTM C 578 and have a minimum density of 1.3 pounds per cubic feet (14.4 kg/m^3); or</u>
~~2~~<u>3</u>. Polyurethane meeting the physical properties shown in Table R613.3.1, or;
~~3~~<u>4</u>. An *approved* alternative.

All cores shall meet the requirements of Section R316.

<u>**R613.3.7 Thermal Barrier.** SIP walls shall be separated from the interior of a building by an *approved* thermal barrier in accordance with section R316.4.</u>

<u>**R613.5.3 Panel to panel connection.** SIPs shall be connected at vertical in-plane joints in accordance with Figure R613.5.3 or by other *approved* methods.</u>

<u>**R613.5.4 Corner framing.** Corner framing of SIP walls shall be constructed in accordance with Figure R613.5.4.</u>

~~**R613.5.3**~~ <u>**R613.5.5**</u> **Wall bracing.** SIP walls shall be braced in accordance with Section R602.10. SIP walls shall be considered continuous wood structural panel sheathing for purposes of computing required bracing. SIP walls shall meet the requirements of Section R602.10.4.2 except that SIPs corners shall be fabricated as shown in Figure R613.9. When SIP walls are used for wall bracing, the SIP bottom plate shall be attached to wood framing below in accordance with Table R602.3(1).

~~**R613.8 Connection.** SIPs shall be connected at vertical in-plane joints in accordance with Figure R613.8 or by other *approved* methods.~~

~~**R613.9 Corner framing.** Corner framing of SIP walls shall be constructed in accordance with Figure R613.9.~~

~~**R613.10**~~ <u>**R613.8**</u> **Headers.** SIP headers shall be designed and constructed in accordance with Table R613.~~10~~<u>8</u> and Figure R613.5.1. SIPs headers shall be continuous sections without splines. Headers shall be at least 11 7/8 inches (302 mm) deep. Headers longer than 4 feet (1219 mm) shall be constructed in accordance with Section R602.7.

~~**R613.10.1 Wood structural panel box headers.** Wood structural panel box headers shall be allowed where SIP headers are not applicable. Wood structural panel box headers shall be constructed in accordance with Figure R602.7.2 and Table R602.7.2.~~

TABLE R613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP LIGHT-FRAME ROOF ONLY (inches)[a,b,c]

Wind Speed (3-sec gust)		Ground Snow Load (psf)	Building Width (ft)[d]														
			24			28			32			36			40		
			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
Exp A/B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
85	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5.	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~6.5~~ ~~4.5~~	4.5	4.5	~~N/A~~ 4.5
110	100	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~6.5~~ ~~4.5~~
		50	4.5	4.5	4.5	4.5	4.5	~~6.5~~ ~~4.5~~	4.5	4.5	~~6.5~~ ~~4.5~~	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5
		70	4.5	4.5	~~6.5~~ ~~4.5~~	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	6.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	N/A
120	110	20	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5
		30	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	~~6.5~~ ~~4.5~~	~~N/A~~ 4.5
		50	4.5	4.5	~~N/A~~ 4.5	4.5	~~6.5~~ ~~4.5~~	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5
		70	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa.

a. N/A = ~~Not Applicable.~~ Design required.

b. Deflection criterion: L/240

c. Design load assumptions:

~~Deflection criteria: *L*/240.~~

Roof dead load: ~~7~~10 psf.

Ceiling dead load: 5 psf.

Wind loads based on Table R301.2 (2).

Strength axis of facing materials applied vertically.

d. Building width is in the direction of horizontal framing members supported by the header.

TABLE R613.5(2)
MINIMUM THICKNESS FOR SIP WALLS SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF (inches)[a,b,c]

Wind Speed (3 – sec gust)		Ground Snow Load (psf)	Building Width (ft)[d]														
			24			28			32			36			40		
Exp A/B	Exp. C		Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)		
			8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
85	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~N/A~~ 4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~6.5~~	4.5	4.5	~~N/A~~	~~4.5~~	~~N/A~~	~~N/A~~

											4.5			6.5	6.5	6.5	6.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~6.5~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 6.5
		50	4.5	4.5	~~6.5~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5
		70	4.5	4.5	~~N/A~~ 4.5	4.5	6.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	N/A	N/A
110	100	20	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	~~6.5~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5
		30	4.5	4.5	~~N/A~~ 4.5	4.5	4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 6.5
		50	4.5	~~6.5~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	N/A
		70	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 6.5	~~N/A~~ 6.5	N/A	~~N/A~~ 6.5	N/A	N/A	N/A	N/A	N/A
120	110	20	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 6.5	N/A
		30	4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 6.5	N/A	~~N/A~~ 6.5	~~N/A~~ 6.5	N/A
		50	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 6.5	N/A	~~N/A~~ 6.5	N/A	N/A	N/A	N/A	N/A
		70	~~N/A~~ 4.5	~~N/A~~ 4.5	~~N/A~~ 6.5	~~N/A~~ 4.5	~~N/A~~ 6.5	N/A	~~N/A~~ 6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa.

a. N/A = ~~Not Applicable.~~ Design required.

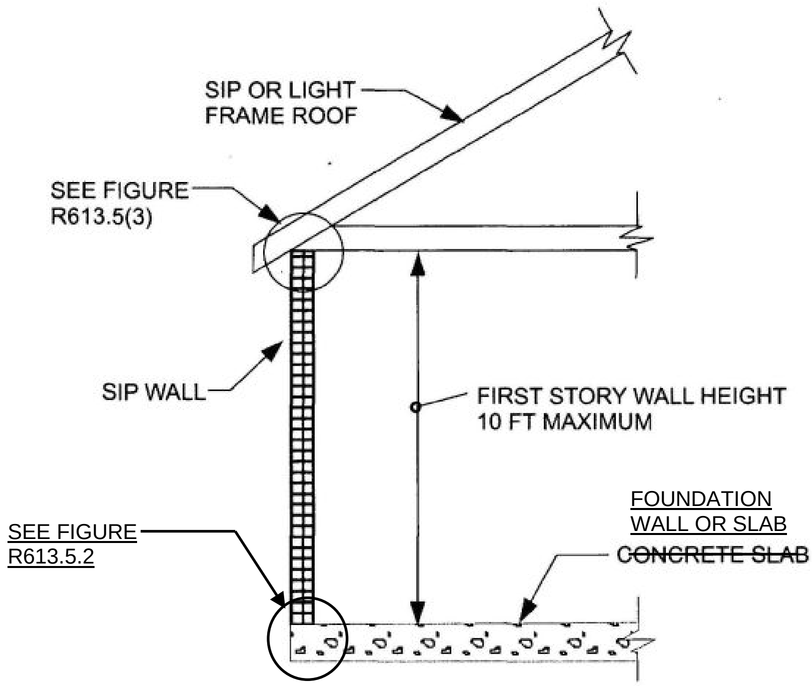
b. Deflection criterion: L/240

c. Design load assumptions:

~~Deflection criteria: *L*/240.~~
Roof dead load: ~~7~~10 psf.
Ceiling dead load: 5 psf.
Second floor live load: 30 psf.
Second floor dead load: 10 psf.
Second floor dead load from walls: 10 psf.
Wind loads based on Table R301.2 (2).

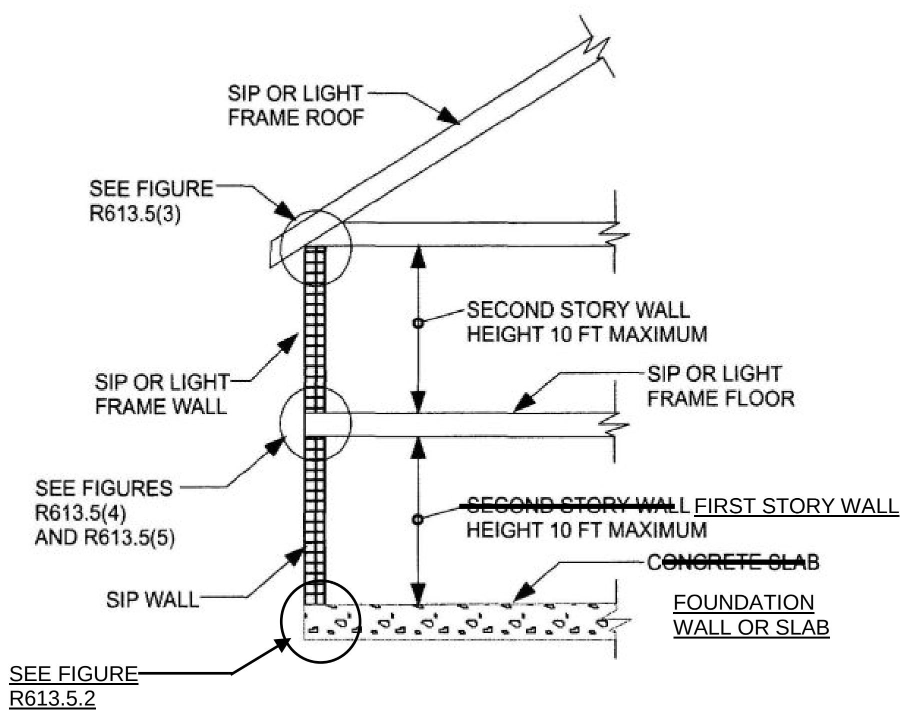
Strength axis of facing materials applied vertically.

d. Building width is in the direction of horizontal framing members supported by the header.



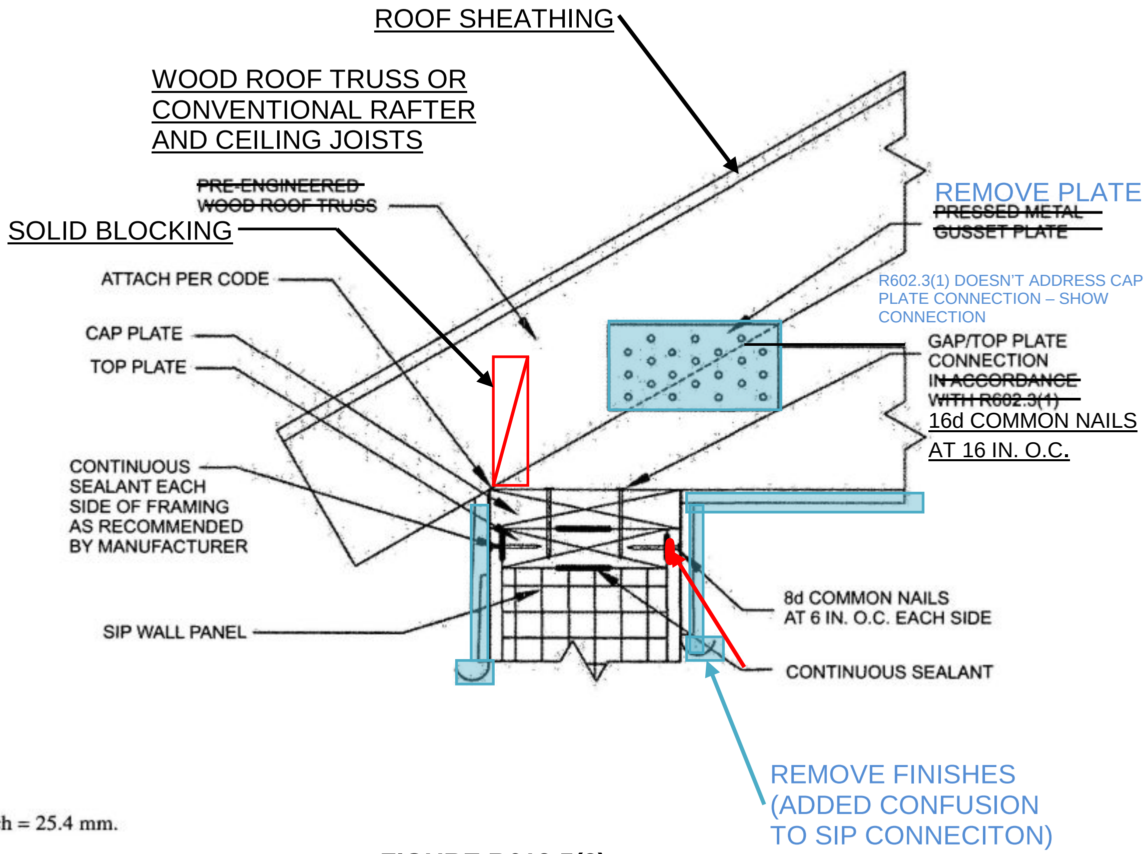
For SI: 1 foot = 304.8 mm.

FIGURE R613.5(1)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS



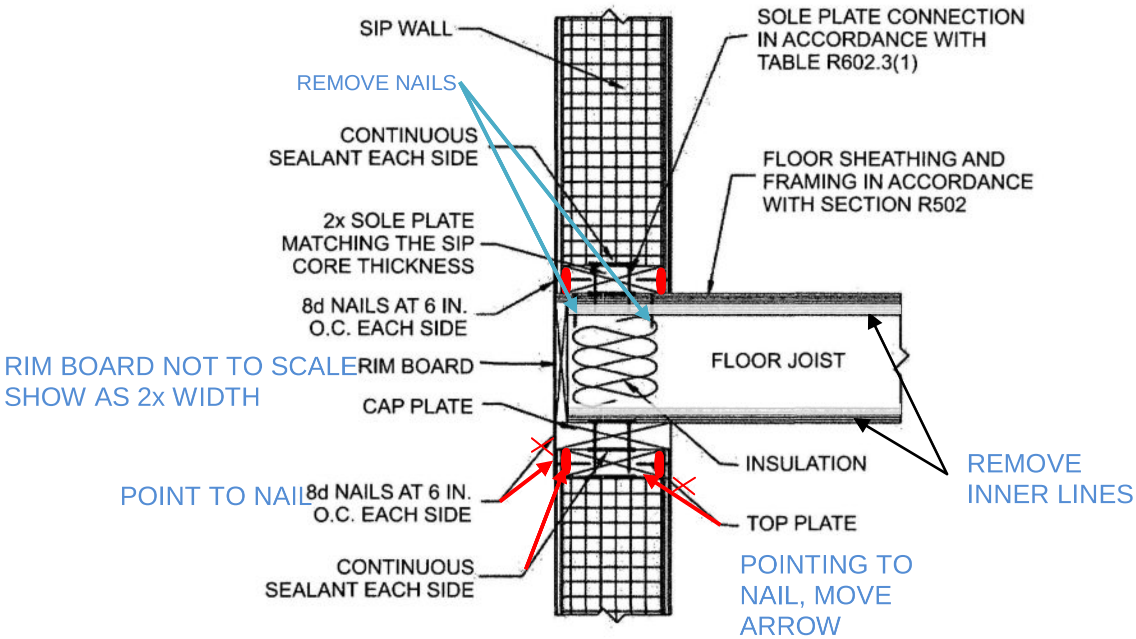
For SI: 1 foot = 304.8 mm.

FIGURE R613.5(2)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS



For SI: 1 inch = 25.4 mm.

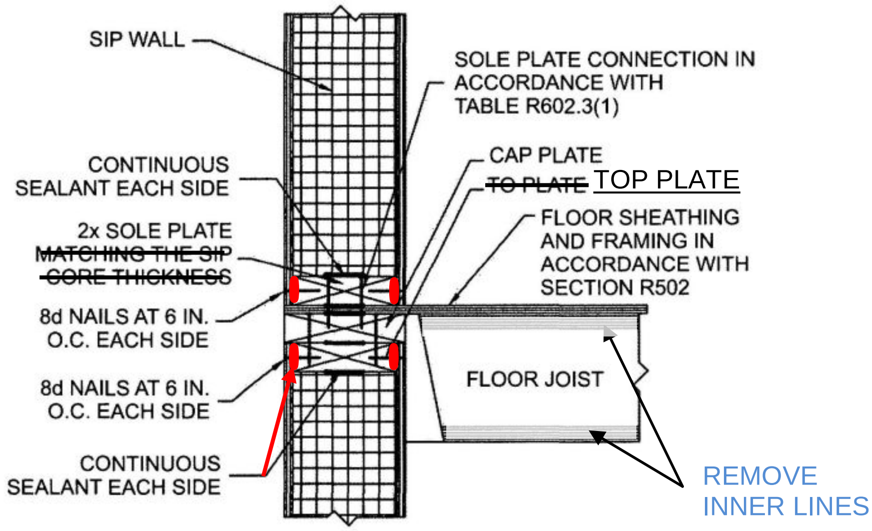
FIGURE R613.5(3)
TRUSSED ROOF TO TOP PLATE CONNECTION



For SI: 1 inch = 25.4 mm.

Note: Figures illustrate SIP-specific attachment requirements. Other connections shall be made in accordance with Table R602.3(1) and (2) as appropriate.

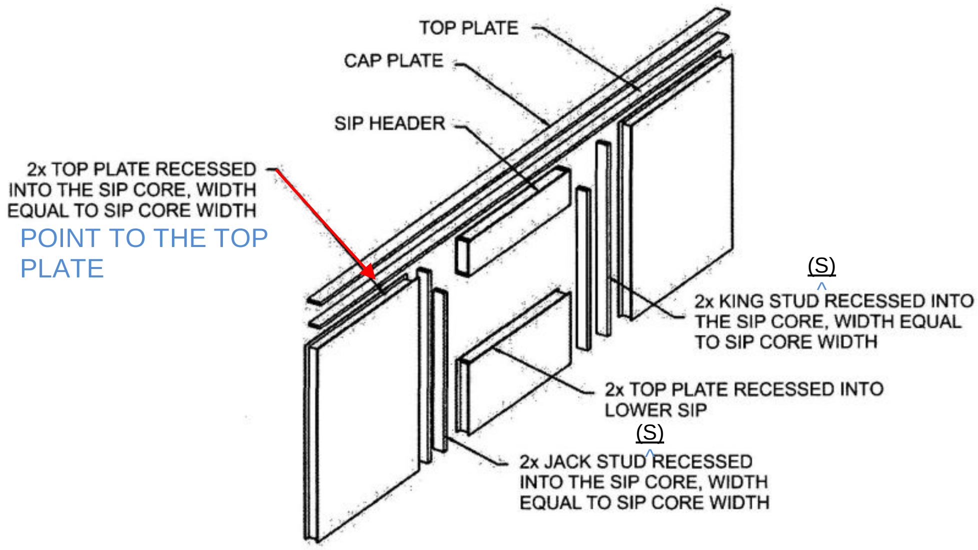
FIGURE R613.5(4)
SIP WALL TO WALL PLATFORM FRAME CONNECTION



For SI: 1 inch = 25.4 mm.

Note: Figures illustrate SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and (2), as appropriate.

FIGURE R613.5(5)
SIP WALL TO WALL ~~BALLOON~~ <u>HANGING FLOOR</u> FRAME CONNECTION ~~(I-Joist floor shown for Illustration only)~~

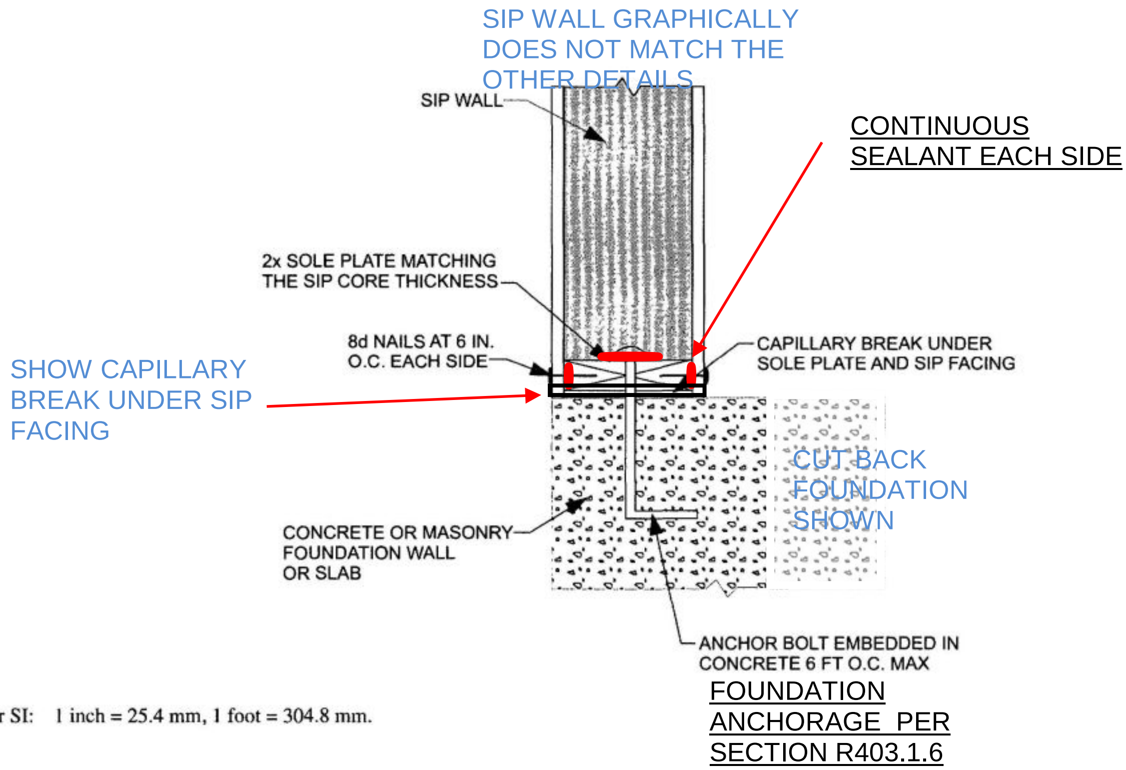


For SI: 1 inch = 25.4 mm.

Notes:

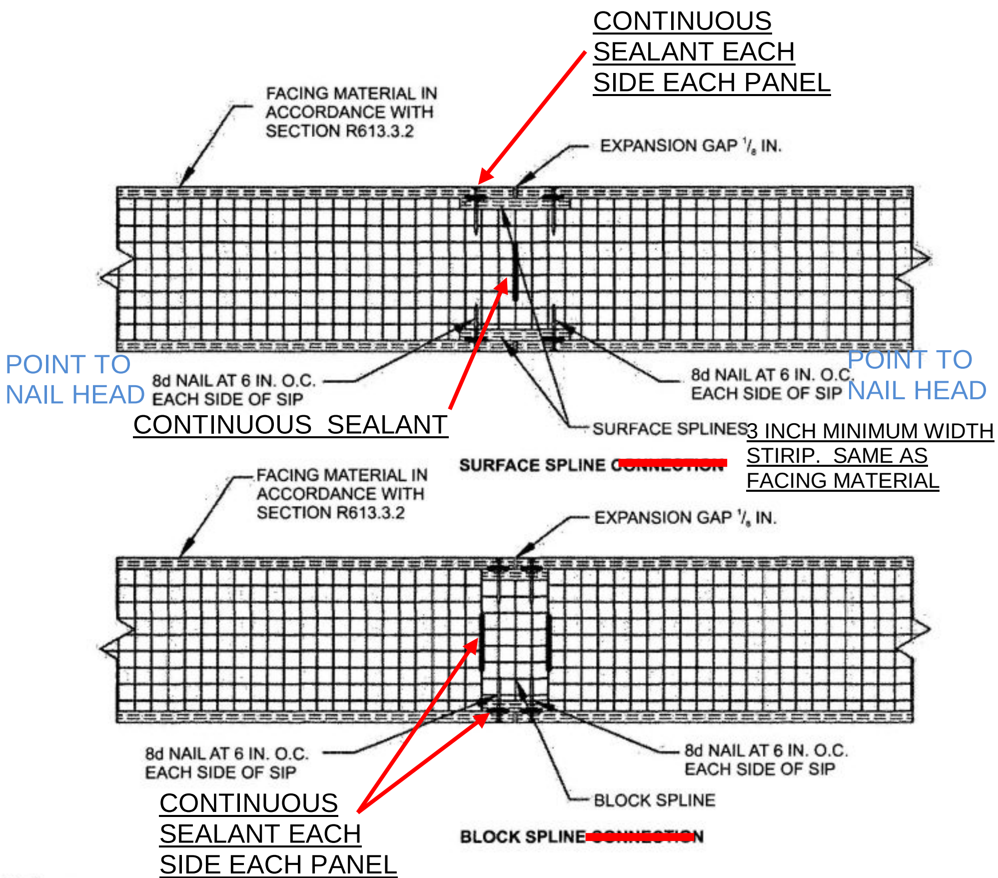
1. Top plates shall be continuous over header.
2. Lower 2x top plate shall have a width equal to the SIP core width and shall be recessed into the top edge of the panel. Cap plate shall be placed over the recessed top plate and shall have a width equal to the SIPs width.
3. SIP facing surfaces shall be nailed to ALL framing and cripples with 8d common or galvanized box nails spaced 6 inches on center.
4. ~~Galvanized nails shall be hot-dipped or tumbled. Framing shall be attached in accordance to Section R602.3(1) unless otherwise provide for in Section R613.~~

FIGURE R613.5.1
SIP WALL FRAMING CONFIGURATION



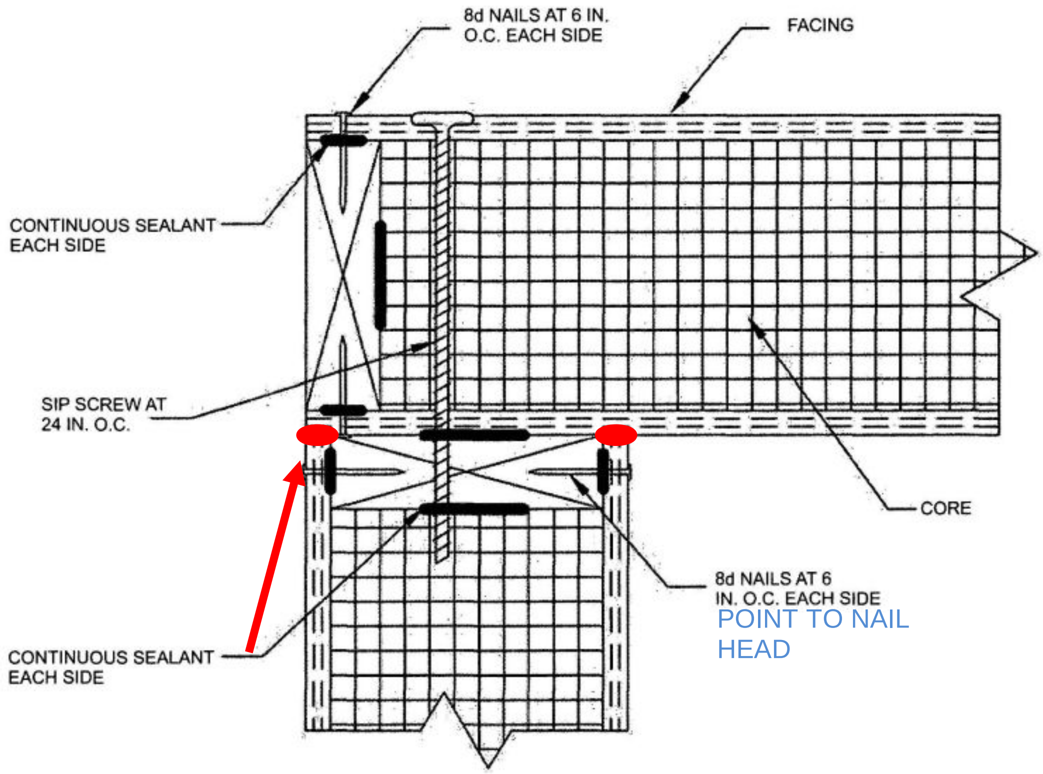
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R613.5.2
SIP WALL TO CONCRETE SLAB FOR FOUNDATION WALL ATTACHMENT



For SI: 1 inch = 25.4 mm.

FIGURE ~~R613.8~~R613.5.3
TYPICAL SIP WALL PANEL TO PANNEL CONNECTION DETAILS ~~FOR VERTICAL IN-PLANE JOINTSPANEL-TO-PANEL CONNECTION~~



For SI: 1 inch = 25.4 mm.

FIGURE ~~R613.9~~R613.5.4
SIP CORNER FRAMING DETAIL

TABLE R613.~~10~~8
MAXIMUM SPANS FOR ~~117/8 INCH DEEP~~ SIP HEADERS (feet)[a, b]

LOAD CONDITION	GROUND SNOW LOAD (psf)	Building width (feet)[c]				
		24	28	32	36	40
Supporting roof only	20	4	4	4	~~4~~ 2	2
	30	4	4	~~4~~ 2	2	2
	50	2	2	2	2	2
	70	2	2	2	N/A	N/A
Supporting roof and one-story	20	2	2	N/A	N/A	N/A
	30	2	2	N/A	N/A	N/A
	50	2	N/A	N/A	N/A	N/A
	70	N/A	N/A	N/A	N/A	N/A

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.
N/A = ~~Not Applicable.~~ Design required.
a. Deflection criterion: L/240
b. Design load assumptions:
~~Maximum deflection criterion: *L*/360.~~
~~Maximum r~~Roof dead load: 10 psf.
~~Maximum c~~Ceiling dead load: 5 psf.
~~Maximum s~~Second floor live load: 30 psf.
~~Maximum s~~Second floor dead load: 10 psf.
~~Maximum s~~Second floor dead load from walls: 10 psf.
c. The table provides for roof slopes between 3:12 and 12:12
d. Maximum Roof overhang 24 inches (610mm).
e. Building width is in the direction of horizontal framing members supported by the header.

Reason: The proposal is a reorganization of the entire Structural Insulated Panels (SIPs) section. The intention is to add clarity to the proposal as it is currently written. The original SIP language was based on the HUD document Prescriptive Method for Structural Insulated Panels (SIPs) Used In Wall Systems In Residential Construction. Since the inclusion of SIPs in the IRC, there have been several changes that have revised the SIP requirements, however, in some instances the changes have do not match the language used in other materials (wood, cold formed steel, ect.). Proposed changes are intended to bring the SIPs provisions more in line with the other sections of the IRC.

To Summarize the changes:

- R613.3.1 changes to the core requirements – to bring the specifications from the Structural Insulated Panel Association specifications into the code
- R613.3.7 add thermal barrier requirements from the HUD document into section R613.
- R613.5.3/4 move the connection requirements into the section designated for connections.
- R613.10.1 – remove wood structural headers, since section R602.7 already includes wood structural headers. This section is redundant and not necessary.
- Table 613.5 (1) & (2) – add footnotes to match the presentation of the wood and cold form steel tables. Changes to the values are to bring the thickness from the original HUD document back to the tables.
- Figure changes are editorial and take into account the original HUD and the current Structural Insulated Panel Association detail requirements.
- Table 613.10 header span table, based on the allowable HUD header SIP capacities, revise the allowable spans.

Bibliography: *Prescriptive Method for Structural Insulated Panels (SIPs) Used In Wall Systems In Residential Construction,* U.S. Department of Housing and Urban Development Office of Policy Development and Research, Washington, DC, 2007.

Cost Impact: The code change proposal will not increase the cost of construction.

RB347-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R613.3.1-RB-KERR.doc

RB348 – 13
R614 (NEW)

Proponent: Joseph D. Belcher, JDB Code Services, Inc, representing the International Hurricane Protection Association (joe@jdbcodeservices.com)

Add new text as follows:

SECTION R614
IMPACT PROTECTIVE SYSTEMS

R614.1 Safety factor. Impact protective systems shall be tested at 1.5 times the design pressure (positive or negative) expressed in pounds per square feet as determined by the Section R301.2.1.1 of this code for which the specimen is to be tested.

R614.1.1 Labels required. Impact protective systems shall be approved and shall be tested in accordance with Section R301.2.1.2 and shall be labeled as conforming to the standards listed in Section R301.2.1.2 and in accordance with the provisions of this section. Impact resistant glazing shall be labeled in accordance with Section R612.6.1

R614.2 Labels. A permanent label shall be provided on all impact protective systems.

Exception: Wood structural panels permitted at section R301.2.1.2.

R614.2.1 Label information required. The following information shall be included on the labels on impact protective systems:

1. The manufacturer's name and address,
2. The approved testing and labeling agency, and
3. The rated wind design pressure, positive and negative.

Exception: Impact resistant glazing shall comply with Section R612.6.1

R614.3 Location of label. The location of the label on the impact protective systems shall be as follows:

1. Accordions: Bottom of the locking bar or center mate facing the exterior or outside.
2. Rollup: On the bottom of the hood facing the exterior or outside or on the bottom slat facing the exterior or outside.
3. Bahama Awning or Colonial Hinged: On the bottom, placed on the back of the impact protective system.
4. Panels: For metal and plastic panels the label may be embossed or printed spaced not more than every three (3) lineal feet on each panel. The label shall be applied by the manufacturer and shall face the exterior or outside.
5. Framed products: The label shall be on the side or bottom facing the exterior or outside.
6. Labels on all other products shall face the exterior or outside.

Exception: Labels for impact resistant glazing shall comply with Section R612.6.1

R614.4 Installation. All impact protective systems shall be installed in accordance with the manufacturer's installation instructions. Installation instructions shall be provided and shall be available to inspection personnel on the job site.

Reason: Similar provisions have been adopted in the Florida Building Code to assist code enforcement personnel in the inspection of impact protective systems. The Garage Door-Window Labeling Work Group was appointed by the Florida Building Commission in response to problems cited by building officials in determining if the proper impact resistant coverings were provided on a job. In many cases it was found the homeowner was not getting a good product or the product was installed incorrectly. The Workgroup consisted of broad range of interests including a number of manufacturers of both impact protective covering systems and impact rated glazing products, contractors, insurance industry representatives, and code enforcement personnel which identified and worked on the issues. This proposal incorporates the recommendations of the Workgroup.

Cost Impact: The cost of providing labels on impact resistant covering products is estimated by the industry as follows:

a. Water Resistant Self-adhering Permanent Labels approximately $0.15 per label. Such labels would most likely be used on Accordion, Roll, Bahama, and Colonial style shutters.

b. Embossed or ink jet labels used on metal and plastic panels would cost approximately $0.05 per label.

There is no added cost to impact resistant glazing products as they are currently required by the code to be labeled.

The industry believes the minor cost involved is by far outweighed by the benefits to the public by providing data permitting inspection personnel and the general public to ascertain the proper impact resistant covering is provided and installed in accordance with the manufacturer's installation instructions.

RB348-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R614 (NEW)-RB-BELCHER.doc

RB349 – 13

R109.1.5.1, R202 (NEW), R702.3, R702.3.1, R702.3.2, R702.3.3, R702.3.5, Table R702.3.5, R702.3.6, R702.3.7, Table R702.3.7, R702.5, R703.11.2.1, R703.11.2.2,

Proponent: Michael Gardner, Gypsum Association (mgardner@gypsum.org)

Revise as follows:

R109.1.5.1 Fire-resistance-rated construction inspection. Where fire-resistance-rated construction is required between *dwelling units* or due to location on property, the *building official* shall require an inspection of such construction after all lathing and/or ~~wallboard is~~ gypsum board or gypsum panel products are in place, but before any plaster is applied, or before ~~wallboard~~ board or panel joints and fasteners are taped and finished.

Add new definition as follows:

GYPSUM PANEL PRODUCT. The general name for a family of sheet products consisting essentially of gypsum.

Revise as follows:

R702.3 Gypsum board and gypsum panel products.

R702.3.1 Materials. All gypsum board and gypsum panel product materials and accessories shall conform to ASTM C 22, C 475, C 514, C1002, C 1047, C 1177, C 1178, C 1278, C 1396 or C 1658 and shall be installed in accordance with the provisions of this section. Adhesives for the installation of gypsum board and gypsum panel products shall conform to ASTM C 557.

R702.3.2 Wood framing. Wood framing supporting gypsum board and gypsum panel products shall not be less than 2 inches (51 mm) nominal thickness in the least dimension except that wood furring strips not less than 1-inch by 2-inch (25 mm by 51 mm) nominal dimension may be used over solid backing or framing spaced not more than 24 inches (610 mm) on center.

R702.3.3 Cold-formed steel framing. Cold-formed steel framing supporting gypsum board and gypsum panel products shall not be less than 1 1/4 inches (32 mm) wide in the least dimension. Nonload-bearing cold-formed steel framing shall comply with ASTM C645. Load-bearing cold-formed steel framing and all cold- formed steel framing from 0.033 inch to 0.112 inch (1 mm to 3 mm) thick shall comply with ASTM C 955.

R702.3.5 Application. Maximum spacing of supports and the size and spacing of fasteners used to attach gypsum board and gypsum panel products shall comply with Table R702.3.5. Gypsum sheathing shall be attached to exterior walls in accordance with Table R602.3(1). Gypsum board and gypsum panel products shall be applied at right angles or parallel to framing members. All edges and ends of gypsum board and gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Interior gypsum board shall not be installed where it is directly exposed to the weather or to water.

R702.3.6 Fastening. Screws for attaching gypsum board and gypsum panel products to wood framing shall be Type W or Type S in accordance with ASTM C 1002 and shall penetrate the wood not less than 5/8 inch (16 mm). Gypsum board and gypsum panel products shall be attached to cold-formed steel framing with minimum No. 6 screws. Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing less than 0.033 inch (1 mm) thick shall be Type S in accordance with ASTM C 1002 or bugle head style in accordance with ASTM C 1513 and shall penetrate the steel not less than 3/8 inch (9.5 mm). Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing 0.033 inch to 0.112 inch (1 mm to 3 mm) thick shall be in accordance with ASTM C 954 or bugle head style in accordance with ASTM C 1513. Screws for attaching gypsum board and gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than 7/16 inch (11 mm).

R702.3.7 Horizontal gypsum board diaphragm ceilings. ~~Use of gypsum~~ Gypsum board and gypsum panel products shall be permitted on wood joists to create a horizontal *diaphragm* in accordance with Table R702.3.7. Gypsum board and gypsum panel products shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of board and panels shall not occur on the same joist. The maximum allowable *diaphragm* proportions shall be 11/2:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted. Gypsum board or gypsum panel products shall not be used in *diaphragm* ceilings to resist lateral forces imposed by masonry or concrete construction. All perimeter edges shall be blocked using wood members not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board or gypsum panel product.

R702.5 Other finishes. Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches (406 mm) on center. Wood veneer and hard board paneling less than 1/4-inch (6mm) nominal thickness shall not have less than a 3/8-inch (10mm) gypsum board or gypsum panel product backer. Wood veneer paneling not less than 1/4-inch (6 mm) nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to CPA/ANSI A135.5.

R703.11.2.1 Basic wind speed not exceeding 90 miles per hour and Exposure Category B. Where the basic wind speed does not exceed 90 miles per hour (40 m/s), the Exposure Category is B and gypsum ~~wall~~ board, gypsum panel product or equivalent is installed on the side of the wall opposite the foam plastic sheathing, the minimum siding fastener penetration into wood framing shall be 11/4 inches (32 mm) using minimum 0.120-inch diameter nail (shank) with a minimum 0.313-inch diameter head, 16 inches on center. The foam plastic sheathing shall be minimum 1/2-inch-thick (12.7 mm) (nominal) extruded polystyrene per ASTM C 578, 1/2-inch-thick (12.7 mm) (nominal) polyisocyanurate per ASTM C 1289, or 1-inch-thick (25 mm) (nominal) expanded polystyrene per ASTM C 578.

R703.11.2.2 Basic wind speed exceeding 90 miles per hour or Exposure Categories C and D. Where the basic wind speed exceeds 90 miles per hour (40 m/s) or the Exposure Category is C or D, or all conditions of Section R703.11.2.1 are not met, the adjusted design pressure rating for the assembly shall meet or exceed the loads listed in Tables R301.2(2) adjusted for height and exposure using Table R301.2(3). The design wind pressure rating of the vinyl siding for installation over solid sheathing as provided in the vinyl siding manufacturer's product specifications shall be adjusted for the following wall assembly conditions:

1. For wall assemblies with foam plastic sheathing on the exterior side and gypsum ~~wall~~ board, gypsum panel product, or equivalent on the interior side of the wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.39.
2. For wall assemblies with foam plastic sheathing on the exterior side and no gypsum ~~wall~~ board, gypsum panel product or equivalent on the interior side of wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.27.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS

THICKNESS OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING[c]
				Nails[a]	Screws[b]	

Application without adhesive						
$^{3}/_{8}$	Ceiling[d]	Perpendicular	16	7	12	13 gage, $1^{1}/_{4}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{1}/_{4}$" long, annular-ringed; or 4d cooler nail, 0.080" diameter, $1^{3}/_{8}$" long, $^{7}/_{32}$" head.
	Wall	Either direction	16	8	16	
$^{1}/_{2}$	Ceiling	Either direction	16	7	12	13 gage, $1^{3}/_{8}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{1}/_{4}$" long, annular-ringed; 5d cooler nail, 0.086" diameter, $1^{5}/_{8}$" long, $^{15}/_{64}$" head; or gypsum board nail, 0.086″ diameter, $1\ ^{5}/_{8}$" long, $^{9}/_{32}$" head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
$^{5}/_{8}$	Ceiling	Either direction	16	7	12	13 gage, $1^{5}/_{8}$" long, $^{19}/_{64}$"head; 0.098" diameter, $1^{3}/_{8}$" long, annular-ringed; 6d cooler nail, 0.092" diameter, $1^{7}/_{8}$" long, $^{1}/_{4}$" head; or gypsum board nail, 0.0915" diameter, $1^{7}/_{8}$" long, $^{19}/_{64}$" head.
	Ceiling[e]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
Application with adhesive						
$^{3}/_{8}$	Ceiling[d]	Perpendicular	16	16	16	Same as above for $^{3}/_{8}$" gypsum board and gypsum panel products
	Wall	Either direction	16	16	24	
$^{1}/_{2}$ or $^{5}/_{8}$	Ceiling	Either direction	16	16	16	Same as above for $^{1}/_{2}$" and $^{5}/_{8}$" gypsum board, and gypsum panel products respectively
	Ceiling[d]	Perpendicular	24	12	16	
	Wall	Either direction	24	16	24	
Two $^{3}/_{8}$ layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for $^{1}/_{2}$" gypsum board and gypsum panel product; face ply installed with adhesive
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than $2^{1}/_{2}$ inches apart may be used with the pair of nails spaced 12 inches on center.

b. Screws shall be in accordance with Section R702.3.6. Screws for attaching gypsum board or gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than $^{7}/_{16}$ inch.

c. Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than $^{5}/_{8}$ inch longer than the gypsum board or gypsum panel product thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, $13^{1}/_{2}$ gage, $^{15}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{1}/_{2}$-inch gypsum board or gypsum panel product; and 6d, 13 gage, $1^{7}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{5}/_{8}$-inch gypsum board or gypsum panel product.

d. Three-eighths-inch-thick single-ply gypsum board or gypsum panel product shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board or gypsum panel product shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be increased from $^{3}/_{8}$ inch to $^{1}/_{2}$ inch for 16-inch on center framing, and from $^{1}/_{2}$ inch to $^{5}/_{8}$ inch for 24-inch on center framing or $^{1}/_{2}$-inch sag-resistant gypsum ceiling board shall be used.

e. Type X gypsum board or gypsum panel products for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum 6 inches o.c. by minimum $1^{7}/_{8}$ inches 6d coated nails or equivalent drywall screws.

TABLE R702.3.7
SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES

MATERIAL	THICKNESS OF MATERIAL (min.) (inch)	SPACING OF FRAMING MEMBERS (max.) (inch)	SHEAR VALUE[a, b] (plf of ceiling)	MINIMUM FASTENER SIZE[c, d]

Gypsum board <u>or gypsum panel product</u>	$^1/_2$	16 o.c.	90	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head
Gypsum board <u>or gypsum panel product</u>	$^1/_2$	24 o.c.	70	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$-inch head

For SI: 1 inch = 25.4 mm, 1 pound per linear foot = 1.488 kg/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading caused by wind or seismic loading. Values shall be reduced 25 percent for normal loading.

b. Values shall be reduced 50 percent in Seismic Design Categories D_0, D_1, D_2 and E.

c. $1^1/_4$-inch, #6 Type S or W screws may be substituted for the listed nails.

d. Fasteners shall be spaced not more than 7 inches on center at all supports, including perimeter blocking, and not less than $^3/_8$ inch from the edges and ends of the gypsum board <u>or gypsum panel product</u>.

Reason: This proposal inserts the term gypsum panel product in Chapter 7 where relevant. It also revises Section 109, and adds a definition for gypsum panel products to Chapter 2. It parallels a proposal that was approved and incorporated into the IBC during the 2012 Group A hearing process.

Gypsum panel product is a term that was created by the gypsum manufacturing industry to describe gypsum sheet products that are manufactured unfaced or with a facing other than paper. Glass mat-faced and unfaced gypsum sheet materials are examples of gypsum panel products.

The process of installing a gypsum board and a gypsum panel is identical in nearly every instance addressed by the code. While the ASTM manufacturing standards for many gypsum panel products (ref. C 1278; C1178; C1658; C1177) were incorporated into Chapter 7 during the past decade, the general text of Chapter 7 was not updated to reflect the incorporation of the materials manufactured to the manufacturing standards. This proposal addresses this issue.

A proposal being submitted by the Building Code Action Committee will add a definition for gypsum board to the IRC. The definitions for gypsum board and gypsum panel product are extracted from ASTM International Standard C 11, *Standard Terminology Relating to Gypsum and Related Building Materials and Systems*. Other sections of the IRC requiring parallel modification will be addressed in subsequent editions of the code.

Cost Impact: The code change proposal will not increase the cost of construction.

RB349-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R109.1.5.1-RB-GARNDER.doc

RB350 – 13
R702.3.3, Chapter 44

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Revise as follows:

R702.3.3 Cold-formed steel framing. Cold-formed steel framing supporting gypsum board shall not be less than 11/4 inches (32 mm) wide in the least dimension. Nonload-bearing cold-formed steel framing shall comply with AISI S220 and ASTM C 645, Section 10. Load-bearing cold-formed steel framing ~~and all cold- formed steel framing from 0.033 inch to 0.112 inch (1 mm to 3 mm)~~ ~~thick~~ shall comply with AISI S200 and ASTM C 955, Section 8.

Add new standards to Chapter 44 as follow:

AISI

AISI S200—12 North American Standard for Cold-formed Steel Framing-General Provisions
AISI S220—11 North American Standard for Cold-formed Steel Framing-Nonstructural Members

Reason: This proposal represents the results of a major effort to synchronize and coordinate the industry standards related to cold-formed steel framing. ASTM Committees C11 and A05, and AISI have been working within the steel framing industry on this "Code Synchronization" effort, the goal of which is to organize and maintain a single path for the building code requirements of cold-formed steel light frame construction products. To this end, a new document, AISI S220, was developed to contain all the necessary requirements for nonload-bearing (nonstructural) products. AISI S220 represents a clarification and coordination of industry requirements. The Steel Framing Industry Association (SFIA), the Steel Stud Manufacturers Association (SSMA), the Association of the Wall and Ceiling Industry (AWCI), and the Gypsum Association (GA) all participated in this effort.

The proper integration of AISI S220 into the IRC requires the following changes in Section R702.3.3:

- Because of the addition of the reference for nonload-bearing cold-formed steel framing, the lower limit of the minimum base thickness has been deleted.
- AISI S200 and AISI S220 have been added to the section as the primary references. Only ASTM C645 Section 10, and ASTM C955 Section 8, which cover the requirements for the Penetration Test for screws, have been retained. These sections provide a procedure for evaluating the member's ability to pull the head of a screw below the surface of gypsum sheathing. At this time, AISI S220 does not include this test. Future editions may include it, allowing for the eventual deletion of the specific references to ASTM C645 and C955. AISI S200 and AISI S220 incorporate the material and manufacturing provisions previously included in ASTM C955 and ASTM C645 respectively. Limiting the specific references to ASTM C645 Section 10 and C955 Section 8 removes the "dual paths to code compliance", which has caused confusion in the cold-formed steel framing industry.

Additionally, changes have been made to Chapter 44 to reflect the necessary changes to the referenced standards.

Please note that a coordinating proposal for the IBC – Proposal S245-12 – was approved as submitted in the ICC Group A cycle last year.

AISI has posted a review copy of AISI S220 on their website. To obtain a copy, please do the following:

Go to: www.steel.org
Click on the link "*AISI Codes and Standards*"
Then click on the link "*Standards and Specifications*"

Then click on the title of the standard, which is at the top of the list under "*New Standards: To Be Referenced in Future Codes*"

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standards proposed for inclusion in the code, AISI S200 and AISI S220 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB350-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.3.3-RB-MANLEY.doc

RB351 – 13
R702.3.5, R702.3.6

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee (bajnaic@chesterfield.gov), and Adolf Zubia, Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee

Revise as follows:

R702.3.5 Application. ~~Maximum spacing of~~ Supports ~~and the size~~ and ~~spacing of~~ fasteners used to attach gypsum board shall comply with Table R702.3.5. Gypsum sheathing shall be attached to exterior walls in accordance with Table R602.3(1). Gypsum board shall be applied at right angles or parallel to framing members. All edges and ends of gypsum board shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Interior gypsum board shall not be installed where it is directly exposed to the weather or to water.

~~R702.3.6~~ <u>R702.3.5.1Screw</u> Fastening. Screws for attaching gypsum board to wood framing shall be Type W or Type S in accordance with ASTM C 1002 and shall penetrate the wood not less than 5/8 inch (16 mm). Gypsum board shall be attached to cold-formed steel framing with minimum No. 6 screws. Screws for attaching gypsum board to cold-formed steel framing less than 0.033 inch (1 mm) thick shall be Type S in accordance with ASTM C 1002 or bugle head style in accordance with ASTM C 1513 and shall penetrate the steel not less than 3/8 inch (9.5 mm). Screws for attaching gypsum board to cold-formed steel framing 0.033 inch to 0.112 inch (1 mm to 3 mm) thick shall be in accordance with ASTM C 954 or bugle head style in accordance with ASTM C 1513. Screws for attaching gypsum board to structural insulated panels shall penetrate the wood structural panel facing not less than 7/16 inch (11 mm).

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) and the ICC Fire Code Action Committee (FCAC). These ICC committees were established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Codes or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the these committees have held 6 open meetings and numerous workgroup meetings which included members of the committees as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the CAC website at: http://www.iccsafe.org/cs/CAC/Pages/default.aspx.

The intent is to clarify the application of Table R702.3.5, and that the fastening requirements of current Section R702.3.6 are actually a subsection of Section R702.3.5 and the referenced table. There are no technical changes to current text.

Cost Impact: The code change will not increase the cost of construction.

RB351-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.3.5-RB-BAJNAI-BCAC.doc

RB352 – 13
R202, Table R702.3.5, R1001.11, Table N1102.4.1.1 (IECC R402.4.1.1)

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaiC@chesterfield.gov)

Revise as follows:

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD

e. Type X gypsum board for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum 6 inches o.c. by minimum 1 7/8 inches 6d coated nails or equivalent ~~drywall~~ length screws. Screws shall comply with Section R702.3.6.

(Portions of Table not shown remains unchanged)

Add new definition as follows:

GYPSUM BOARD. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum *veneer* plaster, exterior gypsum soffit board, predecorated gypsum board and water-resistant gypsum backing board complying with the standards listed in Section R702.3 and Part IX of this code are types of gypsum board.

Revise as follows:

R1001.11 Fireplace clearance. All wood beams, joists, studs and other combustible material shall have a clearance of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The air space shall not be filled, except to provide fire blocking in accordance with Section R1001.12.

Exceptions:

1. Masonry fireplaces *listed* and *labeled* for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials such as wood siding, flooring and ~~drywall~~ gypsum board shall be permitted to abut the masonry fireplace side walls and hearth extension in accordance with Figure R1001.11, provided such combustible trim or sheathing is a minimum of 12 inches (305 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim may be placed directly on the masonry fireplace front surrounding the fireplace opening providing such combustible materials are not placed within 6 inches (152 mm) of a fireplace opening. Combustible material within 12 inches (306 mm) of the fireplace opening shall not project more than $^1/_8$ inch (3 mm) for each 1-inch (25 mm) distance from such an opening.

Revise as follows:

TABLE N1102.4.1.1 (R402.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	CRITERIA[a]
Recessed lighting	Recessed light fixtures installed in the building

	thermal envelope shall be air tight, IC rated, and sealed to the ~~drywall~~ gypsum board.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or ~~drywall~~. gypsum board.

(Portions of Table not shown remains unchanged)

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The term drywall is used as an apparent synonym for gypsum board in the International Residential Code in three instances. In a fourth instance, it is used as an adjective to describe a specific fastener.

The term drywall, however, is not defined in the IRC. As a result, references to it should be removed from the code and replaced with technically correct language.

Unfortunately, the IRC does not include a definition for the technically proper term for drywall: gypsum board. To correct this, the proposal adds a definition for gypsum board that is identical to the definition for gypsum board that will appear in the 2015 edition of the International Building Code. The IBC definition was modified by approved proposal S304-12 during the Group A hearings in 2012.

The proposed definition is also technically identical to the definition contained in the ASTM standards referenced in Section R702.3.

Section R1001.11 and Table N1102.4.1.1 are amended by removing the term drywall and substituting the term gypsum board. Footnote e of Table R702.3.5 is amended by removing the term drywall, adding the term length, and adding a reference to Section R702.3.6.

Standards defining screws appropriate for the application of gypsum board are defined in R702.3.6. Adding the term length to the footnote clarifies that any screw used as a substitute for a nail in a fire-resistive installation of gypsum board must be of an equivalent length to the nail prescribed for the installation.

Cost Impact: The code change proposal will not increase the cost of construction.

RB352-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.3.5T-RB-BAJNAI-BCAC.doc

RB353 – 13
R302.6, Table R702.3.5

Proponent: Robert Rice, Josephine County, OR, representing Oregon Building Officials Association (structdesigner@yahoo.com)

Revise as follows:

R302.6 Dwelling/garage fire separation. The garage shall be separated as required by Table R302.6. Attachment of gypsum board shall comply with Table R702.3.5. Openings in garage walls shall comply with Section R302.5. ~~This~~ The wall separation provisions of Table R302.6 ~~does~~ do not apply to garage walls that are perpendicular to the adjacent *dwelling unit* wall.

TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD

THICKNESS OF GYPSUM BOARD (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING[c]
				Nails[a]	Screws[b]	
Application without adhesive						
$^{3}/_{8}$	Ceiling[d]	Perpendicular	16	7	12	13 gage, $1^{1}/_{4}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{1}/_{4}$" long, annular-ringed; or 4d cooler nail, 0.080" diameter, $1^{3}/_{8}$" long, $^{7}/_{32}$" head.
	Wall	Either direction	16	8	16	
$^{1}/_{2}$	Ceiling	Either direction	16	7	12	13 gage, $1^{3}/_{8}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{1}/_{4}$" long, annular-ringed; 5d cooler nail, 0.086" diameter, $1^{5}/_{8}$" long, $^{15}/_{64}$" head; or gypsum board nail, 0.086″ diameter, $1\ ^{5}/_{8}$" long, $^{9}/_{32}$" head.
	Ceiling[d]	Perpendicular	24	7	12	
	Wall	Either direction	24	8	12	
	Wall	Either direction	16	8	16	
$^{5}/_{8}$	Ceiling	Either direction	16	7	12	13 gage, $1^{5}/_{8}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{3}/_{8}$" long, annular-ringed; 6d cooler nail, 0.092" diameter, $1^{7}/_{8}$" long, $^{1}/_{4}$" head; or gypsum board nail, 0.0915" diameter, $1^{7}/_{8}$" long, $^{19}/_{64}$" head.
	Ceiling[e]	Perpendicular	24	7	12	
	Type X at garage ceiling beneath habitable rooms	Perpendicular	24	6	6	1 7/8 inches 6d coated nails or equivalent drywall screws.
	Wall	Either direction	24	8	12	13 gage, $1^{5}/_{8}$" long, $^{19}/_{64}$" head; 0.098" diameter, $1^{3}/_{8}$" long, annular-ringed; 6d cooler nail, 0.092" diameter, $1^{7}/_{8}$" long, $^{1}/_{4}$" head; or gypsum board nail, 0.0915" diameter, $1^{7}/_{8}$" long, $^{19}/_{64}$" head.
	Wall	Either direction	16	8	16	
Application with adhesive						
$^{3}/_{8}$	Ceiling[d]	Perpendicular	16	16	16	Same as above for $^{3}/_{8}$" gypsum board
	Wall	Either direction	16	16	24	
$^{1}/_{2}$ or $^{5}/_{8}$	Ceiling	Either direction	16	16	16	Same as above for $^{1}/_{2}$" and $^{5}/_{8}$" gypsum

	Ceiling[d]	Perpendicular	24	12	16	board, respectively
	Wall	Either direction	24	16	24	
Two $^{3}/_{8}$ layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for $^{1}/_{2}$" gypsum board; face ply installed with adhesive
	Wall	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm.

a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than $2^{1}/_{2}$ inches apart may be used with the pair of nails spaced 12 inches on center.

b. Screws shall be in accordance with Section R702.3.6. Screws for attaching gypsum board to structural insulated panels shall penetrate the wood structural panel facing not less than $^{7}/_{16}$ inch.

c. Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than $^{5}/_{8}$ inch longer than the gypsum board thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, $13^{1}/_{2}$ gage, $^{15}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{1}/_{2}$-inch gypsum board; and 6d, 13 gage, $1^{7}/_{8}$ inches long, $^{15}/_{64}$-inch head for $^{5}/_{8}$-inch gypsum board.

d. Three-eighths-inch-thick single-ply gypsum board shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board shall be applied perpendicular to framing. When applying a water-based texture material, the minimum gypsum board thickness shall be increased from $^{3}/_{8}$ inch to $^{1}/_{2}$ inch for 16-inch on center framing, and from $^{1}/_{2}$ inch to $^{5}/_{8}$ inch for 24-inch on center framing or $^{1}/_{2}$-inch sag-resistant gypsum ceiling board shall be used.

~~e. Type X gypsum board for garage ceilings beneath habitable rooms shall be installed perpendicular to the ceiling framing and shall be fastened at maximum 6 inches o.c. by minimum $1^{7}/_{8}$ inches 6d coated nails or equivalent drywall screws.~~

Reason: The existing code requires 5/8" Type X gypsum board on garage ceilings when there are habitable rooms above. The general requirement for separations is stated in R302.6 and that section refers to Table R302.6 (shown below) for the specific requirements. The code also has special attachment requirements for this application that are different from other gypsum board attachments. The problem with the current code is that the requirement for the attachment is in a footnote to Table R702.3(5) and is often overlooked. This proposal is to move the requirement for the attachment from the footnote of Table R702.3(5) to the table itself. A sentence is added to R302.6 to point the user to the attachment requirements in Table R702.3(5).

TABLE R302.6
DWELLING/GARAGE SEPARATION

SEPARATION	MATERIAL
From the residence and attics	Not less than $^{1}/_{2}$-inch gypsum board or equivalent applied to the garage side
From all habitable rooms above the garage	Not less than $^{5}/_{8}$-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than $^{1}/_{2}$-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than $^{1}/_{2}$-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

In addition, since Section R302.6 refers to the Table that covers both walls and ceilings, language is added to clarify the existing language. The current text says, "This provision does not apply to garage walls that are perpendicular to the adjacent *dwelling unit* wall". As currently written, it says the provisions of R302.6 don't apply which is the whole section R302.6. Since R302.6 is scoping in nature and sends the user to Table R702.3(5) for technical requirements this change makes it clear that the ceiling requirements still apply.

This proposal does not change any requirements in the existing code.

Cost Impact: The code change proposal will not increase the cost of construction.

RB353-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.3.5T-RB-RICE.doc

RB354 – 13
R702.3.8

Proponent: Michael Gardner, Gypsum Association (mgardner@gypsum.org)

Revise as follows:

R702.3.8 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C 1396, C 1178 or C1278. Use of water-resistant gypsum backing board shall be permitted on ceilings. ~~here framing spacing does not exceed 12 inches (305 mm) on center for 1/2-inch-thick (12.7 mm) or 16 inches (406 mm) for 5/8-inch-thick (16 mm) gypsum board.~~ Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

Reason: The supplemental framing requirement in R702.3.8 was placed in the Uniform Building Code many decades ago when concerns about sagging of ceiling-applied water-resistant gypsum board were more pronounced. It has become irrelevant because of contemporary board manufacturing practices that incorporate lighter weight water-resistance additives. The newer additives also make the core of the board stiffer and less susceptible to sag.

The gypsum board application standards, ASTM C840 and GA-216, have been modified to eliminate prescriptive requirements mandating the installation of supplemental framing support members when water-resistant gypsum board is applied to a ceiling. The ASTM C 840 standard is a consensus standard and reflects the input of manufacturers, contractors, and other interested parties.

Identical language was removed from Chapter 25 of the IBC during the Group 'A' hearings in 2012. The intent of this proposal is to make the 2015 IRC consistent with referenced industry standards and the 2015 IBC and to remove `language that has become an occasionally overlooked catch-point for applicators and designers.

Standard wallboard and water-resistant gypsum board are manufactured to the same standard, ASTM C 1396. The humidified deflection and flexural strength tolerances for both products are identical. On the basis of the manufacturing standard, water-resistant gypsum board is no more susceptible to sag than standard wallboard.

Cost Impact: The code change proposal will not increase the cost of construction. Will create a cost savings a fewer framing members will be required.

RB354-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.3.8-RB-GARDNER.doc

RB355 – 13
R702.4.2, Table R702.4.2 (NEW), Chapter 44

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement* and Self

Revise as follows:

R702.4.2 <u>**Backer Boards**</u> **~~Fiber-cement, fiber-mat reinforced cementitious backer units, glass mat gypsum backers and fiber-reinforced gypsum backers.~~** ~~Fiber-cement, fiber mat reinforced cementitious backer units, glass mat gypsum backers or fiber-reinforced gypsum backers in compliance with ASTM C 1288, C 1325, C 1178 or C 1278, respectively, and installed in accordance with manufacturers' recommendations shall be~~ <u>Materials</u> used as backers for wall tile in tub and shower areas and wall panels in shower areas <u>shall be of materials listed in Table R702.4.2, and installed in accordance with the manufacturer's recommendations.</u>

<u>**R702.4.2**</u>
<u>**BACKER BOARD MATERIALS**</u>

<u>**MATERIAL**</u>	<u>**STANDARD**</u>
<u>Glass mat gypsum backing panel</u>	<u>ASTM C 1178</u>
<u>Fiber-reinforced gypsum panels</u>	<u>ASTM C 1278</u>
<u>Nonabestos fiber-cement backer board</u>	<u>ASTM C 1288 or ISO 8336, Category C</u>
<u>Nonasbestos fiber mat reinforced cementitious backer units</u>	<u>ASTM C 1325</u>

Add new standard to Chapter 44 as follows:

ISO

<u>ISO 8336 Fibre-Cement Flat Sheets – Product Specification and Test Methods</u>

Reason: The current wording is cumbersome for the backer board materials permitted for use in this section. The text is revised to reference permitted backer board materials now defined in new TABLE R702.4.2 where all 4 permitted products would now be listed. This revision also makes the addition of future recognized products to the Code easier by simple addition to the table. Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1288, *Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets*. Fiber-cement producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement products for compliance with ISO 8336. The inclusion of this Standard reference in the IRC will permit manufacturers worldwide to demonstrate product compliance to IBC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade.

IBC Section 2509.2 has, as a result of the Group A IBC Code Hearings, been revised to adopt this format for approved product presentation. The addition of the new referenced ISO standard and "product category" were also approved during the Group A IBC Code Hearings. This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment.

Cost Impact: The code change proposal will not increase the cost of construction because the proposed code change is editorial in nature to better clarify and present the backer board products currently recognized in the Code.

Analysis: A review of the standard proposed for inclusion in the code, ISO 8336 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB355-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.4.2-RB-MULDER.doc

RB356 – 13
R702.7, R702.7.1, R702.7.2

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com)

Revise as follows:

R702.7 Vapor retarders. Vapor retarders shall be in accordance with this section.

> **Exception:** Construction where moisture or its freezing will not damage the materials are exempt from Section R702.7.

R702.7.1 Vapor retarders required. Class I or II vapor retarders ~~are required~~ shall be used on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. ~~Construction where moisture or its freezing will not damage the materials.~~ Where Class III vapor retarders are used as specified in Table R702.7.1.

~~**R702.7.1 Class III vapor retarders.** Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met.~~

R702.7.2 Vapor retarders prohibited. The following shall not be used**:**

1. Class I or II vapor retarders on the interior side of frame walls in Zones 1 and 2.
2. Class I vapor retarders on the interior side of frame walls in Zones 3 and 4.
3. Materials in frame walls with a Class I vapor retarder to either the inside or the outside, shall not have a Class I or II vapor retarder to the other side.

Reason: This change prohibits a number of situations where vapor retarders could cause problems by trapping moisture. This change also splits the "required" from the "prohibited" for clarity.

New items #1 and #2- In cooling climates vapor retarders to the inside can trap moisture in the cooled walls.

New item #3- Exterior wall materials will get wet. Moisture sensitive materials need be allowed to dry. A Class I vapor retarder to one side of a material prevents drying to that side; therefore, that material needs to be able to dry to the other side. This would not prohibit materials with Class II vapor retarders to both sides, which allows slow drying to both sides. It would also allow a Class I vapor retarder to one side and a Class III vapor retarder to the other side.

Cost Impact: The code change proposal may increase the cost of construction, but it will help protect construction materials.

RB356-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.7-RB-CONNER.doc

RB357 – 13
R202 (NEW), Table R702.7.1

Proponent: Michael D. Fischer, Kellen Company, representing the Center for the Polyurethanes Industry (mfischer@kellencompany.com)

Revise as follows:

TABLE R702.7.1
CLASS III VAPOR RETARDERS

CLIMATEZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a]
Marine 4	Vented cladding over wood structural panels. Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Continuous insulation with *R*-value ^{3} 2.5 over 2 × 4 wall. ~~Insulated sheathing~~ Continuous insulation with *R*-value ^{3} 3.75 over 2 × 6 wall.
5	Vented cladding over wood structural panels. Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Continuous insulation with *R*-value ≥5 over 2 × 4 wall. ~~Insulated sheathing~~ Continuous insulation with *R*-value ≥7.5 over 2 × 6 wall.
6	Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Continuous insulation with *R*-value ≥7.5 over 2 × 4 wall. ~~Insulated sheathing~~ Continuous insulation with *R*-value ≥11.25 over 2 × 6 wall.
7 and 8	~~Insulated sheathing~~ Continuous insulation with *R*-value ≥10 over 2 × 4 wall. ~~Insulated sheathing~~ Continuous insulation with *R*-value ≥15 over 2 × 6 wall.

For SI: 1 pound per cubic foot = 16 kg/m^3.

a. Spray foam with ~~a minimum density of 2 lb/ft3, and~~ a maximum permeance of 1.5 perms at the installed thickness, applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to meet the ~~insulating sheathing~~ *continuous insulation* requirement where the spray foam *R*-value meets or exceeds the specified ~~insulating sheathing~~ *continuous insulation* *R* value.

Add new definition as follows:

CONTINUOUS INSULATION. Insulation that is uncompressed and continuous across all structural members without thermal bridges other than fasteners and *service* openings. It is installed on the interior or exterior or is integral to any *opaque* surface of the *building envelope.*

Reason: The current IRC vapor retarder requirements specify product application based upon spray foam density. This proposal replaces the density requirement with a permeance requirement that is more appropriate for the intended requirement. Additionally, it will allow the use of more products that meet the intent of the provision but that may fall out of the arbitrary density specification. The addition of the continuous insulation definition is for consistency with ASHRAE 90.1 and other IECC proposals.

Cost Impact: The code change proposal will not increase the cost of construction.

RB357-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.7.1T-RB-FISCHER.doc

RB358 – 13
R702.7, R702.7.1, Table R702.7.1, R702.7.2

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee / American Chemistry Council (jcrandell@aresconsulting.biz)

Revise as follows:

R702.7 Vapor retarders. Vapor retarders as described in Section R702.7.3 shall be provided in accordance with Sections R702.7.1 and R702.7.2 or an approved design using accepted engineering practice for hygrothermal analysis.

R702.7.1 Class I and II Vapor Retarders. Class I or II vapor retarder membranes shall not be provided on the interior face of frame walls in Climate Zones 1 and 2. Class I vapor retarder membranes shall not be provided on the interior face of frame walls in Climate Zones 3 and 4. A Class I or II vapor retarder material ~~are required~~ shall be provided on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4. The appropriate Climate Zone shall be selected in accordance with Table N1101.10

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.
4. Conditions where Class III vapor retarders are required in Section R702.7.2.

~~**R702.7.1**~~**R702.7.2 Class III vapor retarders.** Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met. Only Class III vapor retarder membranes in accordance with Section R702.7.3 shall be used on the interior face of frame walls where continuous insulation with perm rating of less than 1 perm is applied in accordance with Table R702.7.1 on the exterior side of the frame wall.

~~**R702.7.2**~~ **R702.7.3 Material vapor retarder class.** The *vapor retarder class* of any material used as a vapor retarder shall be based on the manufacturer's certified testing or a tested assembly. The following vapor retarder membranes shall be deemed to meet the class specified:

Class I: Sheet polyethylene, nonperforated aluminum foil
Class II: Kraft-faced fiberglass batts or paint with a perm rating greater than 0.1 and less than or equal to 1.0.
Class III: Latex or enamel paint.

TABLE R702.7.1
CLASS III VAPOR RETARDERS

CLIMATE ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a]
Marine 4	Vented cladding over wood structural panels. Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥2.5 over 2x4 wall. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥3.75 over 2x6 wall
5	Vented cladding over wood structural panels. Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥5 over 2x4 wall.

	~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥7.5 over 2x6 wall
6	Vented cladding over fiberboard. Vented cladding over gypsum. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥7.5 over 2x4 wall. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥11.25 over 2x6 wall
7 and 8	~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥10 over 2x4 wall. ~~Insulated sheathing~~ Exterior continuous insulation with R-value ≥15 over 2x6 wall

For SI: 1 pound per cubic foot = 16 kg/m^3.

a. Spray foam with minimum density of 2 lb/ft^3 applied to the interior cavity side of wood structural panels, fiberboard, insulated sheathing or gypsum is deemed to meet the ~~insulated sheathing~~ exterior continuous insulation requirement where the spray foam R-value or the combination of spray foam and exterior continuous insulation R-value meets or exceeds the specified ~~insulated sheathing~~ exterior continuous insulation R-value.

Reason: A similar proposal was approved as submitted for the 2015 IBC (FS 160-12). In this coordinating proposal for the IRC, vapor retarder provisions are identically strengthened to better promote seasonal drying of walls and avoid a "double vapor barrier" condition in combination with a "warm wall" design using insulating sheathing in cold climates. In addition, requirements are clarified to promote proper application and enforcement. For example, provision is added to clarify that low perm vapor retarder membranes on the interior face of walls shall not be used in the warmer climate zones as indicated to avoid a reversed vapor retarder and creation of a condensation plane. Where appropriate, language also is added to differentiate from membrane-type vapor retarders and other materials or practices, such as use of foam plastics which can control vapor condensation as a vapor retarder material and insulation material to prevent dew-point temperatures from occurring within an envelope assembly. Finally, the term "insulated sheathing" is replaced with "continuous insulation" to provide a more generic requirement that is inclusive of a variety of materials that can be used for this purpose.

Cost Impact: The code change proposal will not increase the cost of construction.

RB358-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R702.7-RB-CRANDELL.doc

RB359 – 13
R703.1

Proponent: Rob Pickett, RobPickett &Associates, LLC, representing Log Homes Council (robpickett@vermontel.net)

Revise as follows:

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.8.

<u>**Exception**: Log walls designed and constructed in accordance with the provisions of the ICC-400.</u>

Reason: Where exterior walls are constructed using logs, the log components and joinery system provide the exterior covering, structure, thermal barrier, and interior covering all in one assembly. Log walls are an alternative method of construction that are to be designed and constructed in accordance with ICC400. Weather protection is specifically covered in 305.1.

Cost Impact: The code change proposal will not increase the cost of construction.

RB359-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.1-RB-PICKETT.doc

RB360 – 13
R703.1.1

Proponent: Theresa Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly. <u>In areas with an average annual rainfall exceeding 35 inches, walls shall have an average minimum drainage efficiency of 75 percent when tested in accordance the requirements of ASTM E 2273.</u> Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R702.7 of this code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed according to Section R703.7 or R703.8.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.8, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   - 2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   - 2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   - 2.3. Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).
   - 2.4. Exterior wall envelope assemblies shall be subjected to the minimum test exposure for a minimum of 2 hours.

   The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration or intersections of terminations with dissimilar materials.

Reason: This proposal adds a method of measuring drainage to the requirement for a means of drainage for high rainfall areas. Drainage is an important component of managing water, especially under high rainfall/ exposure conditions, such as those in the Pacific Northwest (Portland, OR 43.5" avg, Seattle, WA 37.7" avg.). Drainage requirements, including the proposed requirement, have been included in the Oregon State Residential Code.

Cost Impact: The code change proposal will increase the cost of construction in locations with high rainfall.

RB360-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.1.1 #1-RB-WESTON.doc

RB361 – 13
R703.1.1

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly<u>. In Marine climate zones in accordance with Section N1101.10 of this code, framed walls shall have either a minimum 1/8" (3mm) airspace between the water-resistive barrier and the exterior veneer or an average minimum drainage efficiency of 75 percent when tested in accordance the requirements of ASTM E 2273</u>. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R702.7 of this code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed according to Section R703.7 or R703.8.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.8, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   - 2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   - 2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   - 2.3. Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).
   - 2.4. Exterior wall envelope assemblies shall be subjected to the minimum test exposure for a minimum of 2 hours.

   The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration or intersections of terminations with dissimilar materials.

Reason: This proposal adds a method of measuring drainage for high rainfall areas in which wall systems have limited drying capability, to the existing requirement for a means of drainage. Drainage is an important component of managing water, especially under high rainfall/ exposure conditions, such as those in the Pacific Northwest and other Marine climates. Additionally, it is becoming increasingly important to manage the moisture durability as the industry moves to more highly insulated walls. The proposed drainage requirements are consistent with those adopted into the Oregon State Residential Code in 2010.

Cost Impact: The code change proposal will increase the cost of construction in locations with high rainfall.

RB361-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.1.1 #2-RB-WESTON.doc

RB362 – 13
R703.2, Chapter 44

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.2 Water-resistive barrier. One layer of ~~No.15 asphalt felt~~ water-resistive barrier, free from holes and breaks, complying with ASTM E 2556, such as ASTM D 226 ~~for~~ Type 1 felt, or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. ~~Such felt or material~~ The water-resistive barrier shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, ~~felt~~ the water-resistive barrier shall be lapped not less than 6 inches (152 mm). The ~~felt or other approved material~~ water-resistive barrier shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. Under paperbacked stucco lath when the paper backing is an approved water-resistive barrier.

Add new standard to Chapter 44 as follows:

ASTM

E2556-10 Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

Reason: The proposal updates the water-resistive barrier reference to the most consensus standard. ASTM E2556 includes house wrap materials, and building papers in addition to traditional felt, and therefore is more representative of the state of the industry. ASTM E2556 is consistent with the current ICC-ES acceptance criteria for water-resistive barriers and therefore should not limit the use of current WRB's. The materials included in ASTM E2556 – felt, Grad D paper, and building wraps – are all installed in the manner currently prescribed in this section of the code.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM E 2556 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB362-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.2 #2-RB-WESTON.doc

RB363 – 13
R703.2

Proponent: Jerry Anderson, City of Overland Park, KS, representing self (jerry.anderson@opkansas.org)

Revise as follows:

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls.
Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. ~~Under paperbacked stucco lath when the paper backing is an approved water-resistive barrier.~~

Reason: The purpose of the code change is to add clarity to the code. The 3rd exception to the requirement for a water resistive barrier has often caused confusion. The requirements for water-resistive barriers as they pertain to exterior plaster (stucco) are found in Section R703.6.3. It is not necessary to have section R703.2 address a product used for exterior plaster when section R703.6.3 properly addresses the requirements pertaining to water-resistive barriers for exterior plaster. The exception makes the code confusing.

Cost Impact: The code change proposal will not increase the cost of construction.

RB363-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.2-RB-ANDERSON.doc

RB364 – 13
R703.2, Chapter 44

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. Under paperbacked stucco lath when the paper backing is an approved water-resistive barrier.
4. <u>In a wall assembly that has been tested in accordance with and meets the requirements of AAMA 504.</u>

Add new standard to Chapter 44 as follows:

AAMA

<u>AAMA 504-05 Voluntary Laboratory Test Method to Qualify Fenestration Installation Procedures</u>

Reason: This proposal provides a testing alternative to the prescriptive water-resistive barrier material and installation provided in R703.2. This will allow for innovation while still ensuring the performance and durability of the WRB system. AAMA 504 is an industry standard that includes the water resistance testing of assemblies including "*certain physical loading and temperature cycling conditions to simulate service conditions*". The inclusion of physical loading and temperature cycling as a durability assessment is important to water-resistive barrier systems as they have low accessibility after construction and are critical to moisture performance of the wall system.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AAMA 504 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB364-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.2 #1-RB-WESTON.docc

RB365 – 13
R703.1.1, R703.2, R703.2.1 (NEW), R703.2.2 (NEW), R703.8

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee and American Chemistry Council (jcrandell@aresconsulting.biz)

Revise as follows:

R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly.
Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R702.7 of this code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed according to Section R703.7 or R703.8.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.8, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   - 2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
   - 2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   - 2.3. Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).
   - 2.4. Exterior wall envelope assemblies shall be subjected to the minimum test exposure for a minimum of 2 hours.

   The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration or intersections of terminations with dissimilar materials.

3. Water resistive barrier materials and methods used as an alternative to Section R703.2.1 or R703.2.2 shall comply with the following:

   1. The testing required by Exception 2 of Section R703.1.1 applies except:

      - 1.1. Cladding is not required.
      - 1.2. The minimum pressure differential shall be 2.86 pounds per square foot (137Pa).
      - 1.3. The minimum test exposure time shall be 15 minutes.
      - 1.4. The performance need not exceed the performance of the water resistive barrier installation specified in Section R703.2.1 or R703.2.2 as tested under identical minimum pressure and exposure time conditions.

   2. The alternative water resistive barrier shall be installed in accordance with the manufacturer's installation instructions.

Comment [J1]: Larry, edited this to better align with intent of the original proposal on this matter.

R703.2 Water-resistive barrier. Water-resistive barriers shall comply with Section R703.2.1 or R703.2.2, or shall be approved in accordance with Section R703.1.1, exception #3.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
2. Under exterior wall finish materials as permitted in Table R703.4.
3. Under paperbacked stucco lath when the paper backing is an approved water-resistive barrier.

R703.2.1 No. 15 asphalt felt. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt ~~or other approved water-resistive barrier~~ shall be applied over studs or sheathing of all exterior walls. Such felt ~~or material~~ shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt ~~or other approved material~~ shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

R703.2.2 Grade D paper. Grade D paper behind exterior plaster and lath shall installed in accordance with Section R703.6.3.

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish or a water-resistive barrier complying with Section R703.2. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   - 1.1. The fenestration manufacturer’s installation and flashing instructions, or for applications not addressed in the fenestration manufacturer’s instructions, in accordance with the flashing manufacturer’s instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   - 1.2. In accordance with the flashing design or method of a registered design professional.
   - 1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason:

This proposal reorganizes Section R703.2 and coordinates with water-resistance requirements of Section R703.1.1 to more completely and clearly address the types of water-resistive barriers currently included in the IRC and define requirements for alternatives. It also coordinates proper integration of flashing with the water-resistive barrier layer in Section R703.8.

Most importantly, this proposal addresses a critical gap in the code by establishing a uniform water penetration performance requirement for all types of "other approved" (alternative) water resistive barriers. The proposed water resistance requirements rely on the same test method already include in Section R703.1.1 and modifies the criteria to be appropriate for testing the WRB layer alone (not including cladding) such that alternative WRB's can be used with any cladding material without having to test a full assembly for each type of cladding or apply criteria in Section R703.1.1 that are meant to be applied with cladding present. The proposed water resistance test criteria (2.86 psf and 15 minute duration) are identical to requirements for water penetration testing of water-resistive barrier coatings in accordance with ASTM E2570 and are appropriately more restrictive than the water-resistance criteria applied to water-resistive air-barrier materials per ASTM E1677.

This change is necessary because some alternative water-resistive barrier materials, such as polymer-based barriers (i.e., "building wraps") are approved for use only requiring a material property to be tested and standards for this type of material, such as ASTM E2556, do not address actual installed performance of the water-resistive barrier including penetrations, fastenings, joint detailing and other factors representative of end-use conditions. In fact, ASTM E 2556 states in its scope that "this specification is limited to the evaluation of materials and does not address installed performance." Installed performance is surely the most important consideration and it is neglected in current standards for some materials.

The main reason for this proposal is that WRB performance is largely governed by how it performs as an installed assembly under in-service moisture exposure conditions. This concern is addressed for some types of WRB materials and installations (e.g., WRB panels, WRB coatings, etc.), but not for others (e.g, polymer-based barriers or wraps).

The significance of this concern over the lack of a uniform water-penetration resistance requirement is documented in the literature (Hall, G.D. and Hoigard, K.R., "Water-Resistive Barriers: How do they compare?", *Interface*, November 205). In particular, this reference evaluated current code requirements, acceptance criteria, and field experience. It also reports comparative test data under installed water exposure conditions. The primary conclusions from the study include:

> *"Current building code provisions offer no rational means of assessing the equivalency of alternative WRB products to ASTM D-266 type 1 asphalt-saturated felt…"*
>
> *"The three water resistance test methods specified in AC38 vary so significantly in test duration and applied hydrostatic pressure that no meaningful comparison of test data can be made. They fail to address several important moisture transport mechanisms that affect the in-service performance of WRBs."*
>
> *"Laboratory tests performed by the authors to simulate potential in-service conditions not addressed by AC38 resulted in water penetration through several commercially available WRB materials that, according to published manufacturer information, passed the requirements of AC38 for Grade D barriers."*

Clearly, these issues must be addressed in the IRC to ensure acceptable and consistent performance of various types of WRB materials and assemblies. Your approval of this proposal will establish a sound foundation for evaluation of alternative WRB materials and installations to avoid inconsistent requirements resulting in poor or inconsistent performance among alternative WRB materials.

Cost Impact: This proposal will not increase the cost of construction.

RB365-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.1.1-RB-CRANDELL.doc

RB366 – 13
R703.4, R703.11.2.1, R703.11.2.2

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org); Jay Crandell, P.E., ARES Consulting

Revise as follows:

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other approved aluminum, stainless steel, zinc-coated or other approved corrosion-resistive fasteners. Where the ~~basic~~ ultimate design wind speed per Figure R301.2(4)A is ~~110~~ 140 miles per hour (~~49~~ 63 m/s) or higher, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R703.11.2.1 Basic wind speed not exceeding ~~90~~ 115 miles per hour and Exposure Category B. Where the ~~basic~~ ultimate design wind speed does not exceed ~~90~~ 115 miles per hour (~~40~~ 51 m/s), the Exposure Category is B and gypsum wall board or equivalent is installed on the side of the wall opposite the foam plastic sheathing, the minimum siding fastener penetration into wood framing shall be 1 1/4 inches (32mm) using minimum 0.120-inch diameter nail (shank) with a minimum 0.313-inch diameter head, 16 inches on center. The foam plastic sheathing shall be minimum 1/2-inch-thick (12.7 mm) (nominal) extruded polystyrene per ASTM C578, 1/2-inch-thick (12.7 mm) (nominal) polyisocyanurate per ASTM C1289, or 1-inch-thick (25 mm)(nominal) expanded polystyrene perASTMC578.

R703.11.2.2 Basic wind speed exceeding ~~90~~ 115 miles per hour or Exposure Categories C and D. Where the ultimate design ~~basic~~ wind speed exceeds ~~90~~ 115 miles per hour (~~40~~ 51 m/s) or the Exposure Category is C or D, or all conditions of Section R703.11.2.1 are not met, the adjusted design pressure rating for the assembly shall meet or exceed the loads listed in Tables R301.2(2) adjusted for height and exposure using Section R301.2(3). The design wind pressure rating of the vinyl siding for installation over solid sheathing as provided in the vinyl siding manufacturer's product specifications shall be adjusted for the following wall assembly conditions:

1. For wall assemblies with foam plastic sheathing on the exterior side and gypsum wall board or equivalent on the interior side of the wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.39.

2. For wall assemblies with foam plastic sheathing on the exterior side and no gypsum wall board or equivalent on the interior side of wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.27.

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates wind speed triggers in Chapter 7 for attachment of wall cladding and for vinyl siding installed over foam sheathing to the equivalent ultimate design wind speed.

Cost Impact: The code change proposal will not increase the cost of construction.

RB366-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.4-RB-CRANDELL-EHRLICH.doc

RB367 – 13
R703.4, Table R703.5 (NEW)

Proponent: Andrew Herseth, US Dept of Homeland Security, Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other *approved* aluminum, stainless steel, zinc-coated or other *approved* corrosion-resistive fasteners. The use of Table R703.4 shall be limited according to the building mean roof height, ultimate design wind speed in accordance with Figure R301.2(4)A, and exposure category in accordance with Section R301.2.1.4 as shown in Table R703.5. Where ~~the basic wind speed in accordance with Figure R301.2(4)A is 110 miles per hour (49 m/s) or higher~~ the limits of Table R703.5 are exceeded, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). For the determination of wall covering attachment, component and cladding loads shall be determined using an effective wind area of 10 ft^2.

TABLE R703.5
LIMITS FOR ATTACHMENT PER TABLE R703.4

Maximum Mean Roof Height			
Basic Wind Speed (mph-3-second gust)	**Exposure**		
-	B	C	D
115	NL	50'	20'
120	NL	30'	DR
130	60'	15'	DR

NL = not limited by Table R703.5, DR = Design Required
For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s

Reason: The proposal is intended to better establish the current limits of the prescriptive fastening table for wall coverings. The prescriptive fastening requirements in Table R703.4 are limited to a maximum design pressure of 30 psf. According to Table R301.2(2), for Zone 5 and an effective wind area of 10 ft^2, the maximum negative pressure for a basic wind speed of 110 mph is 29.1 psf. This value – less than 30 psf – correlates directly with the 110 mph limitation in Section R703.4. However, the tabulated pressures in Table R301.2(2) are for an assumed Exposure B site condition and a mean roof height of 30 feet. For residential buildings with a basic wind speed of 110 mph and Exposure C or D, or a mean roof height greater than 30 feet, the maximum negative pressure would be substantially higher than 30 psf. For example, consider the case of a residential building located in Exposure C, with a mean roof height of 45 ft. The adjustment factor from Table R301.2(3) would be 1.53. The resulting maximum negative design pressure for a basic wind speed of 110 mph would be (29.1 psf) x 1.53 = 44.5 psf. This wall cladding load far exceeds the current implied limitation of Table R703.4 which is 30 psf.

Table R703.5 has been added to simplify the determination of whether prescriptive fastening provisions of Table R703.4 apply to a specific building. The limits in the table indicate where component and cladding pressures exceed 30 psf as a function of wind speed exposure and mean roof height. In most cases, especially in areas with lower wind speeds, the prescriptive fastening requirements in Table R703.4 will be verified as applicable. Chapter 7 of ICC 600 includes prescriptive attachment schedules for exterior wall coverings that may be applied when mean roof height limits per Table R703.5 are exceeded.

FEMA P-499, *Home Builder's Guide to Coastal Construction* (FEMA, 2009), includes Technical Fact Sheet 5.3 which addresses the attachment of siding in areas where wind loads for wall cladding exceed 30 psf as a result of wind speed, and/or exposure category and/or roof mean height by recommending the selection of a siding product rated for those conditions or higher. The manufacturer's product literature or installation instructions should specify the fastener type, size and spacing, and any other installation details such as requirements for the sheathing materials behind vinyl siding that is needed to achieve the product rating.

New language is also added to require design wind pressures to be determined using an effective wind are of 10 ft^2. For wall cladding, the effective wind area will be governed by the effective wind area of an individual fastener which will almost always be less than 10 ft^2.Guidance for Determining Site-Specific Loads in Chapter 8 of FEMA P-55, *Coastal Construction Manual* (FEMA, 2011), recommends that "for cladding and fasteners, the effective wind area should not be greater than the area that is tributary to an individual fastener. In ASCE 7-10, there is no adjustment for wind areas less than 10 ft2; therefore, sheathing suction loads (should be) based on an effective wind area of 10 ft2 for different zones on the roof."

Changing the trigger for using Table R703.4 from a wind speed limit to a pressure limit will result in better correlation of the actual limits of the table. The new attachment criteria would also make IRC consistent w/ ICC 600 and the Florida Building Code (FBC) where attachment provisions for exterior wall coverings are pressure-triggered.

Cost Impact: The code change proposal will not increase the cost of construction.

RB367-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.4-RB-HERSETH-OVERCASH.doc

RB368 – 13

Table R703.4, Chapter 44

Proponent: Louis Wagner, Wagner in the Woods, representing Composite Panel Association (lwagner@fiberboard.org)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

k. Hardboard siding shall comply with CPA/ANSI A135.6. <u>When used as architectural trim it shall comply with CPA/ANSI A135.7.</u>

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 44 as follows:

CPA

<u>ANSI A135.7 – 12 Engineered Wood Trim</u>

Reason: A new hardboard standard has been completed under the ANSI consensus process.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, CPA /ANSI A135.7with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB368-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.4T-RB-WAGNER.doc

RB369 – 13

R703.5.1, R703.5.3, Table R703.5.1(2) (New), Table R703.5.1(3) (NEW), Table R703.5.2, R703.5.3.1, R905.7.5, Table R905.7.5(2) (NEW), R905.8.6

Proponent: David Roodvoets, DLR Consultants, representing Cedar Shake & Shingle Bureau

Revise as follows:

R703.5.1 Application. Wood shakes or shingles shall be installed according to this chapter and the manufacturer's installation instructions. Wood shakes or shingles shall be applied either single-course or double-course over nominal $^1/_2$-inch (13 mm) wood-based sheathing or to furring strips over $^1/_2$-inch (13 mm) nominal nonwood sheathing . A permeable water-resistive barrier shall be provided over all sheathing, with horizontal overlaps in the membrane of not less than 2 inches (51 mm) and vertical overlaps of not less than 6 inches (152 mm). Where furring strips are used, they shall be 1 inch by 3 inches or 1 inch by 4 inches (25 mm by 76 mm or 25 mm by 102 mm) and shall be fastened horizontally to the studs with 7d or 8d box nails and shall be spaced a distance on center equal to the actual weather exposure of the shakes or shingles, not to exceed the maximum exposure specified in Table R703.5.2. The spacing between adjacent shingles to allow for expansion shall ~~not exceed $^1/_4$ inch (6 mm)~~ be 1/8 inch (3 mm) to ¼ inch (6 mm) apart and between adjacent shakes, ~~it~~ shall ~~not exceed $^1/_2$ inch (13 mm)~~ be 3/8 inch (10 mm) to ½ inch (13 mm) apart. The offset spacing between joints in adjacent courses shall be a minimum of $1^1/_2$ inches (38 mm).

TABLE R703.5.1(2)
SINGLE COURSE SIDEWALL FASTENERS

Product Type	Nail Type & Minimum Length
R & R and Sanded Shingles	**Type (in)**
16" and 18" shingles	3d Box 1 1/4
24" Shingles	4d Box 1 1/2
Grooved Shingles	**Type (in)**
16" and 18" shingles	3d Box 1 1/4
24" shingles	4d Box 1 ½
Split and Sawn Shakes	**Type (in)**
18" Straight-Split Shakes	5d Box 1 3/4
18" and 24" Handsplit Shakes	6d Box 2
24" Tapersplit Shakes	5d Box 1 3/4
18" and 24" Tapersawn Shakes	6d Box 2

TABLE R703.5.1(3)
DOUBLE COURSE SIDEWALL FASTENERS

Product Type	Nail Type & Minimum Length
R & R and Sanded Shingles	**Type (in)**
16" and 18" and 24" shingles	5d Box 1 ¾ or same size casing nails
Grooved Shingles	**Type (in)**
16" and 18" and 24"shingles	5d Box 1 3/4
Split and Sawn Shakes	**Type (in)**
18" Straight-Split Shakes	7d Box 2 ¼ or 8d 2 1/2
18" and 24" Handsplit Shakes	7d Box 2 ¼ or 8d 2 1/2
24" Tapersplit Shakes	7d Box 2 ¼ or 8d 2 1/2
18" and 24" Tapersawn Shakes	7d Box 2 ¼ or 8d 2 1/2

TABLE R703.5.2
MAXIMUM WEATHER EXPOSURE FOR WOOD SHAKES AND SHINGLES ON EXTERIOR WALLS[a,b,c]
(Dimensions are in inches)

LENGTH	EXPOSURE FOR SINGLE	EXPOSURE FOR DOUBLE

	COURSE	COURSE
Shingles[a]		
16	~~7 ½~~ 7	12[b]
18	~~8 ½~~ 8	14[c]
24	~~11 ½~~ 10 ½	16[d]
Shakes[a]		
18	~~8 ½~~ 8	14
24	~~11 ½~~ 10 ½	18

For SI: 1 inch = 25.4 mm.

a. Dimensions given are for No. 1 grade.
b. A maximum ~~10-inch~~ 9-inch exposure is permitted for No. 2 grade.
c. A maximum ~~11-inch~~ 10inch exposure is permitted for No. 2 grade.
d. A maximum 14-inch exposure is permitted for No. 2 grade.

~~**R703.5.3 Attachment.** Each shake or shingle shall be held in place by two hot-dipped zinc-coated, stainless steel, or aluminum nails or staples. The fasteners shall be long enough to penetrate the sheathing or furring strips by a minimum of $^1/_2$ inch (13 mm) and shall not be overdriven.~~

703.5.3 Attachment. Wood shakes or shingles shall be installed according to this chapter and the manufacturer's installation instructions. Each shake or shingle shall be held in place by two~~.~~ stainless steel Type 304 , Type 316 or hot-dipped zinc coated galvanized (conforming to minimum standard ASTM A 153 D (1.0 oz./ft^2)) corrosion resistant box nails in accordance with Table R703.5.1(2) or R703.5.1 (3). Alternatively, 16 gauge stainless steel Type 304 or Type 316 staples with crown widths 7/16 inch (11 mm) minimum, ¾ inch (19 mm) maximum shall be used and the crown of the staple shall be placed parallel with the butt of the shake or the shingle. In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately 1 inch (25 mm) above the butt line of the succeeding course and ¾" (19 mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two fasteners, driven approximately 2 inches (51 mm) above the butt line and 3/4 inch (19 mm) from each edge. Fasteners installed within 15 miles 24 km) of salt water coastal areas shall be stainless steel Type 316. Fasteners for fire-retardant-treated in accordance with Section R902 or pressure-impregnated-preservative-treated shakes or shingles in accordance with AWPA U1 shall be, stainless steel Type 316. The fasteners shall be long enough to penetrate and shall penetrate the sheathing or furring strips by a minimum of ½ inch (13mm) and shall not be overdriven. Fasteners for untreated (natural) and treated products shall comply with ASTM F1667.

~~**R703.5.3.1 Staple attachment.** Wood shakes or shingles shall be installed according to this chapter and the manufacturer's installation instructions. Staples for untreated (natural) wood shakes or wood shingles shall be 16 gauge Stainless Steel Type 304,Type 316 (Fasteners installed within 15 miles of salt water coastal areas shall be stainless steel Type 316.) Staples shall not be less than 16 gauge and shall have a crown width of not less than minimum 7/16 inch (11mm), maximum of ¾" and the crown of the staples shall be parallel with the butt of the shake or shingle.~~
~~In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately 1 inch (25mm) above the butt line of the succeeding course and ¾" (19mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two casing nails staples, driven approximately 2 inches (51mm) above the butt line and 3/4" inch (19mm) from each edge. In all application, staples shall be concealed by the course above. With shingles wider than 810 inches (203254mm) two additional nails staples shall be required and shall be nailed driven approximately 1 inch (25mm) apart near the center of the shingle. Fasteners for fire-retardant-treated (as defined in section R902.2) shingles, shakes or pressure-impregnated-preservative-treated shingles or shakes in accordance with AWPA U1 shall be Stainless Steel Type 316, applied as above. Fasteners for untreated (natural) and treated products shall comply with ASTM F1667.~~

Revise as follows:

R905.7.5 Application. Wood shingles shall be installed according to this chapter and the manufacturer's installation instructions. Wood shingles shall be laid with a side lap not less than 1 ½" (38mm) between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall not be less than ¼" to 3/8" (6mm to 10mm). Weather exposures for wood shingles shall not exceed those set in Table R905.7.5. Fasteners for untreated (naturally durable) wood shingles shall be ~~corrosion resistant with a minimum penetration of ½ inch (13mm) into the sheathing~~. ~~For sheathing less than ½ inch (13mm) in thickness, the fasteners shall extend through the sheathing.~~ stainless steel Type 304, Type 316 or hot-dipped zinc coated galvanized (conforming to minimum standard ASTM A 153 D (1.0 oz./ft^2)) box nails in accordance with table R905.7.5 (2). Alternatively, 16 gauge stainless steel Type 304, or Type 316 staples with crown widths 7/16" (11mm) minimum, ¾" (19 mm) maximum shall be used. Fasteners installed within 15 miles (24km) of salt water coastal areas shall be stainless steel Type 316. All fasteners shall have a minimum penetration into the sheathing of ¾ inch (19 mm). For roof sheathing less than ~~½"~~ ¾" in (19 mm) thickness, each fastener shall ~~extend~~ penetrate through the sheathing. Wood shingles shall be attached to the roof with two fasteners per shingle positioned ~~no more than ¾" from each edge and no more than 1 inch (25mm) above the exposure line.~~ in accordance with the manufacturers installation instructions. Fasteners for fire-retardant-treated shingles in accordance with Section R902 or pressure-impregnated-preservative-treated shingles of naturally durable wood in accordance with AWPA U1 shall be stainless steel Type 316 and applied as above. Fasteners for untreated (natural) and treated products shall comply with ASTM F1667.

TABLE R905.7.5 (2)
NAIL REQUIREMENTS FOR WOOD SHAKES AND WOOD SHINGLES

Shakes	**ASTM F 1667 Nail Type and Minimum Length**
18" Straight-Split	5d Box 1 ¾"
18" and 24" Handsplit and Resawn	6d Box 2
24" Tapersplit	5d Box 1 ¾"
18" and 24" Tapersawn	6d Box 2
Shingles	**ASTM F 1667 Nail Type and Minimum Length**
16" and 18"	3d Box 1 ¼"
24"	4d Box 1 ½"

R905.8.6 Application. Wood shakes shall be installed according to this chapter and the manufacturer's installation instructions. Wood shakes shall be laid with a side lap not less than 1 ½" (38mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 3/8 inch to 5/8 inch (9.5mm to 15.9mm) for shakes ~~and~~ including tapersawn shakes ~~of naturally durable wood shall be 3/8 inch to 5/8 inch (9.5 mm to 15.9 mm) for preservative-treated taper sawn shakes.~~ Weather exposures for wood shakes shall not exceed those set in Table R905.8.6. Fasteners for untreated (naturally durable) wood shakes shall be ~~corrosion resistant with a minimum penetration of ½ inch (12.7mm) into the sheathing~~. ~~For sheathing less than ½ inch (13mm) thick, the fasteners shall extend through the sheathing.~~ stainless steel Type 304, Type 316 or hot-dipped zinc coated galvanized (conforming to minimum standard ASTM A 153 D (1.0 oz./ft^2)) corrosion resistant box nails in accordance with Table R905.7.5.(2). Alternatively, 16 gauge Type 304 or Type 316 stainless steel staples, with crowns width 7/16" minimum, ¾" maximum shall be used. Fasteners installed within 15 miles (24 km) of salt water coastal areas shall be stainless steel Type 316. All fasteners shall have a minimum penetration into the sheathing of ¾" inch (19 mm). Where the roof is less than ¾" (19 mm) thick, each fastener shall penetrate through the sheathing. Wood shakes shall be attached to the roof with two fasteners per shake positioned ~~no more than 1 inch (25mm) no more than 2inches (25 mm) above the exposure line.~~ in accordance with the manufacturer's installation instructions Fasteners for fire-retardant-treated (as defined in section R902) shakes or pressure-impregnated-preservative-treated shakes of naturally durable wood in accordance with AWPA U1 shall be stainless steel Type 316 and applied as above. Fasteners for untreated (natural) and treated products shall comply with ASTM F1667.

Reason: There are known cases of wood shakes and shingles falling off roofs due to the use of inferior fasteners and rather than waiting for these incidents to include wall applications it is a proactive measure to increase the specifics of the fasteners used. Specifying "corrosion resistant" is no longer sufficient; the type of fastener to be used is determined by various environmental factors and product types. Increased specifics will improve wall system integrity and lifespan.

Shakes and shingles shall not be applied with the vertical edges tight together as doing this does not leave room for expansion. Defining the spacing requirements further will eliminate this incorrect application method which causes fish-mouthing, cupping and curling.

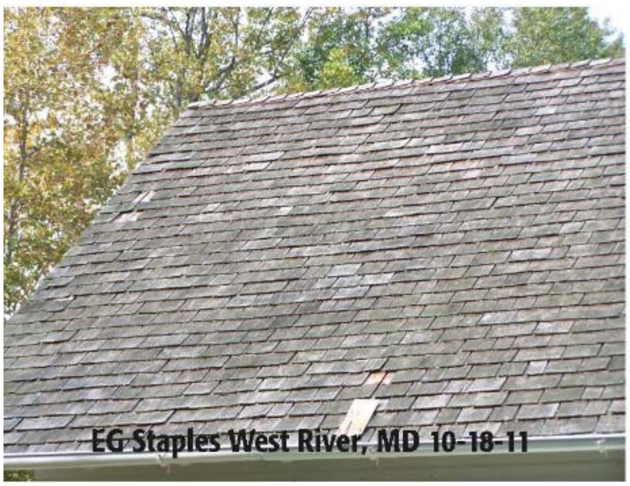
There are known cases of wood shakes and shingles falling off roofs due to the use of inferior fasteners. Specifying “corrosion resistant” is no longer sufficient; the type of fastener to be used is determined by various environmental factors and product type. Increased specifics will improve roof system integrity and lifespan.

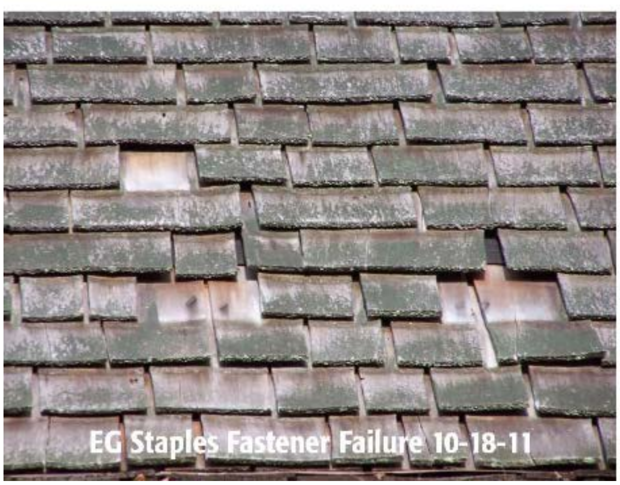
Penetration into sheathing more than ½” thick must be at minimum ¾” or all the way through the sheathing in order to attach the product strongly enough to hold in place and prevent loosening of the fastener.

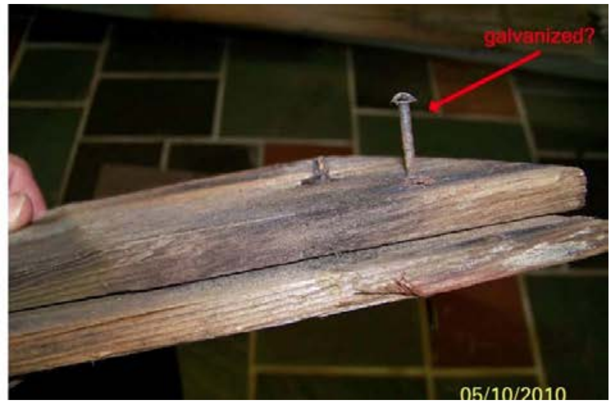
This change simplifies the code.

Following are examples of the failures that this code change is designed to prevent:

Shingles falling off buildings because of corroded fasteners or fasteners that did not adequately penetrate the substrate.







Cost Impact: The increased cost of these changes in comparison to the cost of the entire wall application is negligible.

RB369-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.5.1-RB-ROODVOETS.doc

RB370 – 13
R703.6.3. Chapter 44

Proponent: Theresa Weston, DuPont Building Innovations (Theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.6.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of ~~Grade D paper~~ water-resistive barrier complying with ASTM E 2556 Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.8) intended to drain to the water-resistive barrier is directed between the layers.

> **Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of ~~60 minute Grade D paper~~ a water-resistive barrier complying with ASTM E 2556 Type II and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

Add new standard to Chapter 44 as follows:

ASTM

E 2556 Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment

Reason: The proposal updates the water-resistive barrier reference to the most recent consensus standard. ASTM E2556 includes housewrap materials, building papers and felt, instead of just building paper and therefore is more representative of the state of the industry. Within ASTM E2556 Grade D paper is a Type I WRB and 60 minute Grade D paper is a Type II WRB. ASTM E2556 is consistent with the current ICC-ES acceptance criteria for water-resistive barriers (AC-38) and therefore should not limit the use of current WRBs.

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM E 2556 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB370-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.6.3-RB-WESTON.doc

RB371 – 13

R603.9.2, R603.9.5, Table R603.9.5(1) (NEW), Table R603.9.5(2) (NEW), Table R603.9.5(3) (NEW), Table R603.9.5(4), R603.9.5.1 (NEW), R603.9.5.2 (NEW), Table R703.7(2)

Proponent: J. Daniel Dolan, P.E., Ph.D., Washington State University**,** representing self (jddolan@wsu.edu)

Revise as follows:

TABLE R703.7(2)
STONE OR MASORY VENEER LIMITATIONS AND REQUIREMENTS,
ONE- AND TWO-FAMILY DETACHED DWELLINGS, ~~WOOD FRAMING,~~ SEISMIC DESIGN CATERGORIES D_0, D_1, AND D_2

SEISMIC DESIGN CATEGORY	NUMBER OF ~~WOOD~~ FRAMED STORIES[a]	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf)[b]
D_0	1	20[c]	4	40
	2	20[c]	4	40
	3	30[d]	4	40
D_1	1	20[c]	4	40
	2	20[c]	4	40
	3	20[c]	4	40
D_2	1	20[c]	3	30
	2	20[c]	3	30

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.

a. Cripple walls are not permitted in Seismic Design Categories D_0, D_1 and D_2.

b. Maximum weight is installed weight and includes weight of mortar, grout and lath, and other materials used for installation.

c. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet has a backing of concrete or masonry wall. See also story height limitations of Section R301.3.

d. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. See also story height limitations of Section R301.3.

R603.9.2 Determination of minimum length of full height sheathing. The minimum length of full height sheathing on each *braced wall line* shall be determined by multiplying the length of the *braced wall line* by the percentage obtained from Table R603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table R603.9.2(2). The minimum length of full height sheathing shall not be less than 20 percent of the *braced wall line* length.

To be considered full height sheathing, structural sheathing shall extend from the bottom to the top of the wall without interruption by openings. Only sheathed, full height wall sections, uninterrupted by openings, which are a minimum of 48 inches (1219 mm) wide, shall be counted toward meeting the minimum percentages in Table R603.9.2(1). In addition, structural sheathing shall comply with all of the following requirements:

1. Be installed with the long dimension parallel to the stud framing (i.e., vertical orientation) and shall cover the full vertical height of wall from the bottom of the bottom track to the top of the top track of each *story*. Installing the long dimension perpendicular to the stud framing or using shorter segments shall be permitted provided that the horizontal joint is blocked as described in Item 2.
2. Be blocked when the long dimension is installed perpendicular to the stud framing (i.e., horizontal orientation). Blocking shall be a minimum of 33 mil (0.84 mm) thickness. Each horizontal

structural sheathing panel shall be fastened with No. 8 screws spaced at 6 inches (152 mm) on center to the blocking at the joint.

3. Be applied to each end (corners) of each of the exterior walls with a minimum 48-inch-wide (1219 mm) panel.

Exception: When stone or masonry veneer is installed, the required length of length of full-height sheathing and overturning anchorage required shall be determined in accordance with Section R603.9.5.

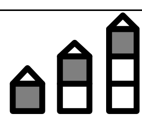
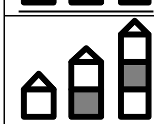
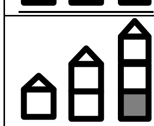
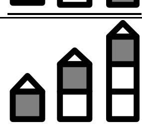
~~**R603.9.5 Structural sheathing for stone and masonry veneer.** In Seismic Design Category C, where stone and masonry veneer is installed in accordance with Section R703.7, the length of structural sheathing for walls supporting one *story*, roof and ceiling shall be the greater of the amount required by Section R603.9.2 or 36 percent, modified by Section R603.9.2 except Section R603.9.2.2 shall not be permitted.~~

R603.9.5 Structural sheathing for stone and masonry veneer. Where stone and masonry veneer are installed in accordance with Section R703.7, the length of full-height sheathing for exterior and interior wall lines backing or perpendicular to and laterally supporting walls with veneer shall comply with this section.

R603.9.5.1 Seismic Design Category C. In Seismic Design Category C, the length of structural sheathing for walls supporting one story, roof and ceiling shall be the greater of the amount required by Section R603.9.2, except Section R603.9.2.2 shall be permitted.

R603.9.5.2 Seismic Design Categories D_0, D_1, and D_2. In Seismic Design Categories D_0, D_1, and D_2, The required length of structural sheathing and overturning anchorage shall be determined in accordance with Tables R603.9.5(1), R603.9.5(2), R603.9.5(3), and R603.9.5(4). Overturning anchorage shall be installed on the doubled studs at the end of each full height wall segment.

TABLE R603.9.5(1)
REQUIRED LENGTH OF FULL HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE							
D_0		3.3	4.7	6.1	7.4	8.8	10.2	3,360	--
		5.3	8.7	12.1	15.4	18.8	22.2	3,360	6,720
		7.3	12.7	18.0	23.4	28.8	34.2	3,360	10,080
D_1		4.1	5.8	7.5	9.2	10.9	12.7	3,360	--

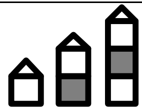
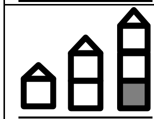
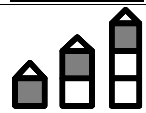
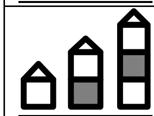
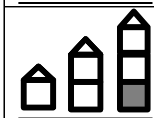
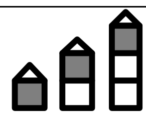
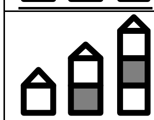
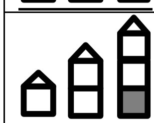
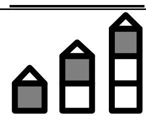
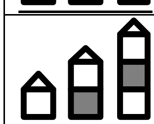
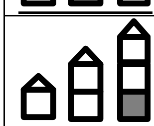
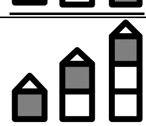
		6.6	10.7	14.9	19.1	23.3	27.5	3,360	6,720
		9/0	15.7	22.4	29.0	35.7	42.2	3,360	10,080
		5.7	8.2	10.6	13.0	15.4	17.8	3,360	--
D_2		9.2	15.1	21.1	27.0	32.9	38.8	3,360	6,720
		12.7	22.1	31.5	40.9	50.3	59.7	3,360	10,080

TABLE R603.9.5(2) REQUIRED LENGTH OF FULL HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE							
		2.8	4.0	5.1	6.3	7.5	8.7	3,960	--
D_0		4.5	7.4	10.2	13.1	16.0	18.8	3,960	7,920
		6.2	10.7	15.3	19.9	24.4	29.0	3,960	11,880
		3.5	4.9	6.4	7.8	9.3	10.7	3,960	--
D_1		5.6	9.1	12.7	16.2	19.8	23.3	3,960	7,920
		7.7	13.3	19.0	24.6	30.3	35.9	3,960	11,880
D_2		4.9	6.9	9.0	11.0	13.1	15.1	3,960	--

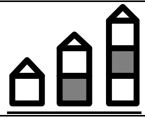
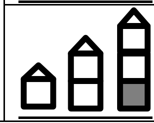
		7.8	12.9	17.9	22.9	27.9	32.9	3,960	7,920
		10.8	18.8	26.7	34.7	42.7	50.7	3,960	11,880

TABLE R603.9.5(3)
REQUIRED LENGTH OF FULL HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

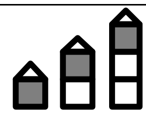
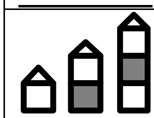
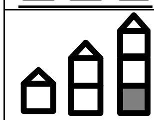
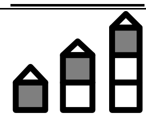
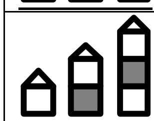
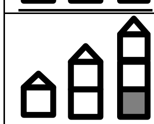
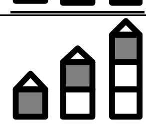
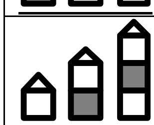
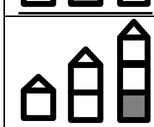
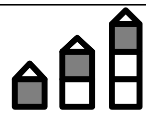
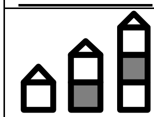
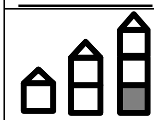
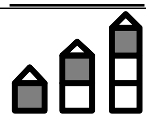
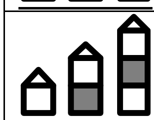
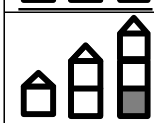
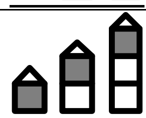
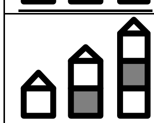
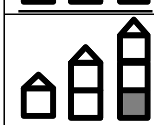
SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE							
D_0		2.5	3.6	4.6	5.7	6.8	7.8	4,392	--
		4.0	6.6	9.2	11.8	14.4	17.0	4,392	8,784
		5.6	9.7	13.8	17.9	22.0	26.2	4,392	13,176
D_1		3.1	4.4	5.7	7.1	8.4	9.7	4,392	--
		5.0	8.2	11.4	14.6	17.8	21.0	4,392	8,784
		6.9	12.0	17.1	22.2	27.3	32.4	4,392	13,176
D_2		4.4	6.2	8.1	10.0	11.8	13.7	4,392	--
		7.1	11.6	16.1	20.6	25.1	29.7	4,392	8,784
		9.7	16.9	24.1	31.3	38.5	45.7	4,392	13,176

TABLE R603.9.5(4)
REQUIRED LENGTH OF FULL HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE							
D_0		1.9	2.7	3.4	4.2	5.0	5.8	5,928	--
		3.0	4.9	6.8	8.8	10.7	12.6	5,928	11,856
		4.1	7.2	10.2	13.3	16.3	19.4	5,928	17,784
D_1		2.3	3.3	4.3	5.2	6.2	7.2	5,928	--
		3.7	6.1	8.5	10.8	13.2	15.6	5,928	11,856
		5.1	8.9	12.7	16.5	20.2	24.0	5,928	17,784
D_2		3.3	4.6	6.0	7.4	8.7	10.1	5,928	--
		5.2	8.6	11.9	15.3	18.6	22.0	5,928	11,856
		7.2	12.5	17.9	23.2	28.5	33.8	5,928	17,784

Reason: The original provisions for anchoring masonry chimneys to residential buildings were developed with the concept of anchoring to wood framing. Cold-formed steel framing can function equivalently in this respect to wood framing, except that the connections between the members, and possibly the size of the members, have to be adjusted for the different types of fasteners used and to prevent the failure mechanisms in steel from occurring.

Table R703.7(2): The table regulating the number of stories that masonry veneer can be used on in the three high seismic zones is changed from specifying wood only to allow cold-formed steel to be used in the same situations. The subsequent parts of the code change provide the required framing detailing changes (i.e. overturning connections) to support the forces generated by the masonry during an earthquake.

R603.9.2: An exception to the method for determining the length of full height sheathing is required to increase the length required to account for the increased lateral loads associated with the increase in mass of the masonry veneer. The exception is simply a pointer to a revised section that provides the correct lengths for each of the Seismic Design Categories associated with high seismic regions.

R603.9.5: This part of the change is the real significant change required to insure that cold-formed steel framing can resist the higher lateral loads associated with the use of masonry in high seismic regions. The values in the four tables are based on the allowable design values provided in the AISI S213-07 wS1-09, *North American Standard for Cold-Formed Steel Framing -- Lateral Design,* in Table C2.1-3 for 33 mil and 43 mil stud thicknesses and 6-inch and 4-inch screw spacing around the perimeter. The assumption of uniform acceleration with respect to height as is allowed by ASCE 7-10 for the simplified method of seismic analysis was used. The maximum acceleration for each seismic zone was used for each seismic design category. It is assumed that the in-line framing concept of cold-formed steel light-frame construction provides the continuous load path required to transfer the overturning loads to the foundation.

Similar assumptions to those made for determining overturning anchorage requirements to those made for wood framing were made for these calculations. The assumptions concerning building configuration included 1) the walls have 20% of the area as door and window openings, 2) the masonry seismic weight that contributed to the lateral forces only included the wall veneer perpendicular to the direction of analysis (i.e., the masonry veneer would support its own seismic weight when loaded in plane.), 3) the story height for each floor was 10 ft., and 4) all of the masonry was 4-inch thick clay masonry for 40 psf dead load.

Cost Impact: This change will increase the cost of construction if stone masonry veneer is used in high seismic regions because it was not previously allowed. However, the increased cost is associated with allowing the option to use stone and masonry veneer in these regions where it is currently not allowed.

RB371-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.7(2)-RB-DOLAN.doc

RB372 – 13

R301.2.2.2.1, R301.2.2.2.2, R301.2.2.3.2, Table R301.7, Table R403.1, Table R403.4, R404.1.5.1, R404.1.5.2, R602.10.3, Table R602.10.3(4), Table R602.10.4, R602.10.6.5, Figure R602.10.6.5, R603.9.5, R703.7, Figure R703.7, Table R703.7(1), Table R703.7(2), R703.7.2, R703.7.2.1, Figure R703.7.2.1, R703.7.2.2, Figure R703.7.2.2, R703.7.3, Table R703.7.3.1, R703.7.3.2, Table R703.7.3.2, Figure R703.7.3.2, R703.7.4, R703.7.5

Proponent: Charles Clark, Brick Industry Association representing Masonry Alliance for Codes and Standards (cclark@bia.org)

Revise as follows:

R301.2.2.2.1 Weights of materials. Average dead loads shall not exceed 15 pounds per square foot (720 Pa) for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot (480 Pa) for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above *grade* shall not exceed:

1. Fifteen pounds per square foot (720 Pa) for exterior light-frame wood walls.
2. Fourteen pounds per square foot (670 Pa) for exterior light-frame cold-formed steel walls.
3. Ten pounds per square foot (480 Pa) for interior light-frame wood walls.
4. Five pounds per square foot (240 Pa) for interior light-frame cold-formed steel walls.
5. Eighty pounds per square foot (3830 Pa) for 8-inch-thick (203 mm) masonry walls.
6. Eighty-five pounds per square foot (4070 Pa) for 6-inch-thick (152 mm) concrete walls.
7. Ten pounds per square foot (480 Pa) for SIP walls.

Exceptions:

1. Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided the wall bracing amounts in Chapter 6 are increased in accordance with Table R301.2.2.2.1.
2. Light-frame walls with <u>anchored</u> stone or masonry veneer shall be permitted in accordance with the provisions of Sections R702.1 and R703.

R301.2.2.2.2 <u>Anchored</u> stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections R702.1 and R703.

R301.2.2.3.2 <u>Anchored</u> stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections R702.1 and R703.

TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS[b, c]

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with no finished ceiling attached to rafters	*L*/180
Interior walls and partitions	*H*/180
Floors/ ceilings with plaster or stucco finish	*L*/360
All other structural members	*L*/240

Exterior walls—wind loads[a] with plaster or stucco finish	*H*/360
Exterior walls with other brittle finishes	*H*/240
Exterior walls with flexible finishes	*H*/120[d]
Lintels supporting anchored stone or masonry veneer walls[e]	*L*/600

Note: *L* = span length, *H* = span height.

a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.

b For cantilever members, *L* shall be taken as twice the length of the cantilever.

c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed *L*/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed *L*/175 for each glass lite or *L*/60 for the entire length of the member, whichever is more stringent. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed *L*/120.

d. Deflection for exterior walls with interior gypsum board finish shall be limited to an allowable deflection of *H*/180.

e. Refer to Section ~~R703.7.2~~ R703.7.3.

TABLE R403.1
MINIMUM WIDTH OF CONCRETE,
PRECAST OR MASONRY FOOTINGS (inches)[a]

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	**2,000**	**3,000**	3 **4,000**
Conventional light-frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch ~~brick~~ anchored stone or masonry veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Where minimum footing width is 12 inches, use of a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted.

TABLE R403.4
MINIMUM DEPTH OF CRUSHED STONE FOOTINGS (D), (inches)

	LOAD-BEARING VALUE OF SOIL (psf)

		1500				2000				3000				4000			
		MH, CH, CL, ML				SC, GC, SM, GM, SP, SW				GP, GW							
		Wall width (inches)				Wall width (inches)				Wall width (inches)				Wall width (inches)			
		6	8	10	12	6	8	10	12	6	8	10	12	6	8	10	12
Conventional light-frame construction																	
1-story	1100 plf	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	1800 plf	8	6	4	4	6	4	4	4	6	4	4	4	6	4	4	4
3-story	2900 plf	16	14	12	10	10	8	6	6	6	4	4	4	6	4	4	4
4-inch ~~brick~~ anchored stone or masonry veneer over light-frame or 8-inch hollow concrete masonry																	
1-story	1500 plf	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	2700 plf	14	12	10	8	10	8	6	4	6	4	4	4	6	4	4	4
3-story	4000 plf	22	22	20	18	16	14	12	10	10	8	6	4	6	4	4	4
8-inch solid or fully grouted masonry																	
1-story	2000 plf	10	8	6	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	3600 plf	20	18	16	16	14	12	10	8	8	6	4	4	6	4	4	4
3-story	5300 plf	32	30	28	26	22	22	20	18	14	12	10	8	10	8	6	4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.89 pounds per linear foot, 1 plf = 2.44 N/m, 1 pounds per square foot = 47.9 N/m^2.

R404.1.5.1 Masonry wall thickness. Masonry foundation walls shall not be less than the thickness of the wall supported, except that masonry foundation walls of at least 8-inch (203 mm) nominal thickness shall be permitted under ~~brick veneered~~ light-frame walls with an anchored stone or masonry veneer and under 10-inch-wide (254 mm) cavity walls where the total height of the wall supported, including gables, is not more than 20 feet (6096 mm), provided the requirements of Section R404.1.1 are met.

R404.1.5.2 Concrete wall thickness. The thickness of concrete foundation walls shall be equal to or greater than the thickness of the wall in the *story* above. Concrete foundation walls with corbels, brackets or other projections built into the wall for support of anchored stone or masonry veneer or other purposes are not within the scope of the tables in this section. Where a concrete foundation wall is reduced in thickness to provide a shelf for the support of anchored stone or masonry veneer, the reduced thickness shall be equal to or greater than the thickness of the wall in the *story* above. Vertical reinforcement for the foundation wall shall be based on Table R404.1.2(8) and located in the wall as required by Section R404.1.2.3.7.2 where that table is used. Vertical reinforcement shall be based on the thickness of the thinner portion of the wall.

Revise as follows:

R602.10.3 Required length of bracing. The required length of bracing along each *braced wall line* shall be determined as follows.

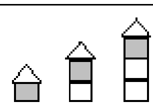
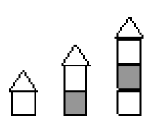
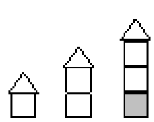
1 All buildings in Seismic Design Categories A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in Seismic Design Category C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.

4. All buildings in Seismic Design Categories D0, D1 and D2 shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4) respectively.

Only *braced wall panel*s parallel to the *braced wall line* shall contribute toward the required length of bracing of that *braced wall line*. *Braced wall panel*s along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the *braced wall line* as shown in Figure R602.10.1.4. Any *braced wall panel* on an angled wall at the end of a *braced wall line* shall contribute its projected length for only one of the *braced wall lines* at the projected corner.

> **Exception:** The length of wall bracing for dwellings in Seismic Design Categories D0, D1 and D2 with anchored stone or masonry veneer installed per Section R703.7 and exceeding the first-story height shall be in accordance with Section R602.10.6.5.

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a, b] [Multiply length from Table R602.10.3(3) by this factor]	APPLICABLE METHODS
Story height (Section 301.3)	Any story	£ 10 feet	1.0	All methods
		> 10 feet and £ 12 feet	1.2	
Braced wall line spacing, townhouses in SDC C	Any story	£ 35 feet	1.0	
		> 35 feet and £ 50 feet	1.43	
Braced wall line spacing, in SDC D_0, D_1, D_2[c]	Any story	> 25 feet and £ 30 feet	1.2	
		> 30 feet and £ 35 feet	1.4	
Wall dead load	Any story	> 8 psf and < 15 psf	1.0	
		< 8 psf	0.85	
Roof/ceiling dead load for wall supporting	Roof only or roof plus one or two stories	£15 psf	1.0	
	Roof plus one or two stories	> 15 psf and £ 25 psf	1.1	
	Roof only	> 15 psf and £ 25 psf	1.2	
Walls with anchored stone or masonry veneer, townhouses in SDC C[d, e]		1.0		All intermittent and continuous methods
		1.5		
		1.5		

Walls with <u>anchored</u> stone or masonry veneer, detached one- and two-family dwellings in SDC D_0 – D_2[d]	Any story	See Table R602.10.6.5		BV-WSP
Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

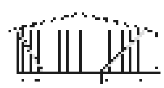
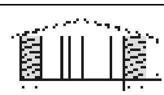
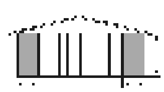
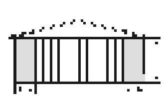
b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.

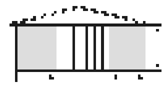
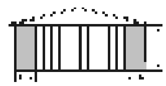
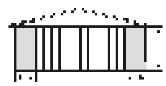
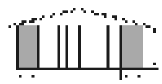
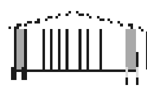
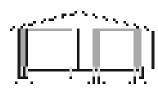
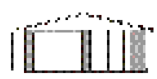
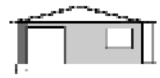
c. The length-to-width ratio for the floor/roof *diaphragm* shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.

d. Applies to <u>anchored</u> stone or masonry veneer exceeding the first story height. See Section R602.10.6.5 for requirements when <u>anchored</u> stone or masonry veneer does not exceed the first story height.

e. The adjustment factor for <u>anchored</u> stone or masonry veneer shall be applied to all exterior *braced wall lines* and all *braced wall lines* on the interior of the building, backing or perpendicular to and laterally ~~supported veneered walls~~ <u>supporting anchored stoen or masonry veneer</u>.

TABLE R602.10.4
BRACING METHODS

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA[a] Fasteners	Spacing
Intermittent Bracing Method	**LIB** Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16^2 stud spacing		Wood: 2-8d common nails or 3-8d ($2^1/_2$″ long x 0.113″ dia.) nails	Wood: per stud and top and bottom plates
				Metal strap: per manufacturer	Metal: per manufacturer
	DWB Diagonal wood boards	$^3/_4$″(1″ nominal) for maximum 24″ stud spacing		2-8d ($2^1/_2$″ long × 0.113″ dia.) nails or 2 - $1^3/_4$″ long staples	Per stud
	WSP Wood structural panel (See Section R604)	$^3/_8$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	BV-WSP[e] Wood Structural Panels with <u>Anchored</u> Stone or Masonry Veneer (See Section R602.10.6.5)	$^7/_{16}$″	See Figure R602.10.6.5	8d common ($2^1/_2$″ × 0.131) nails	4″ at panel edges 12″ at intermediate supports 4″ at braced wall panel end posts
	SFB Structural fiberboard sheathing	$^1/_2$″ or $^{25}/_{32}$″ for maximum 16″ stud spacing		$1^1/_2$″ long × 0.12″ dia. (for $^1/_2$″ thick sheathing) $1^3/_4$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^1/_2$″ long × 0.131″ dia.) nails	3″ edges 6″ field

	GB Gypsum board	$^{1}/_{2}$″		Nails or screws per Table R602.3(1) for exterior locations Nails or screws per Table R702.3.5 for interior locations	For all braced wall panel locations: 7″ edges (including top and bottom plates) 7″ field
	PBS Particleboard sheathing (See Section R605)	$^{3}/_{8}$″ or $^{1}/_{2}$″ for maximum 16″ stud spacing		For $^{3}/_{8}$″, 6d common (2″ long × 0.113″ dia.) nails For $^{1}/_{2}$″, 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field
	PCP Portland cement plaster	See Section R703.6 for maximum 16″ stud spacing		$1^{1}/_{2}$″ long, 11 gage, $^{7}/_{16}$″ dia. head nails or $^{7}/_{8}$″ long, 16 gage staples	6″ o.c. on all framing members
	HPS Hardboard panel siding	$^{7}/_{16}$″ for maximum 16″ stud spacing		0.092″ dia., 0.225″ dia. head nails with length to accommodate $1^{1}/_{2}$″ penetration into studs	4″ edges 8″ field
	ABW Alternate braced wall	$^{3}/_{8}$″		See Section R602.10.6.1	See Section R602.10.6.1
Intermittent Bracing Methods	**PFH** Portal frame with hold-downs	$^{3}/_{8}$″		See Section R602.10.6.2	See Section R602.10.6.2
	PFG Portal frame at garage	$^{7}/_{16}$″		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods	**CS-WSP** Continuously sheathed wood structural panel	$^{3}/_{8}$″		Exterior sheathing per Table R602.3(3)	6″ edges 12″ field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	CS-G[b, c] Continuously sheathed wood structural panel adjacent to garage openings	$^{3}/_{8}$″		See Method CS-WSP	See Method CS-WSP
	CS-PF Continuously sheathed portal frame	$^{7}/_{16}$″		See Section R602.10.6.4	See Section R602.10.6.4
	CS-SFB[d] Continuously sheathed structural fiberboard	$^{1}/_{2}$″ or $^{25}/_{32}$″ for maximum 16" stud spacing		$1^{1}/_{2}$″ long × 0.12″ dia. (for $^{1}/_{2}$″ thick sheathing) $1^{3}/_{4}$″ long × 0.12″ dia. (for $^{25}/_{32}$″ thick sheathing) galvanized roofing nails or 8d common ($2^{1}/_{2}$″ long × 0.131″ dia.) nails	3″ edges 6″ field

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m^2, 1 mile per hour = 0.447 m/s.

a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D_0, D_1 and D_2.

b. Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D_0, D_1 and D_2, roof covering dead load may not exceed 3 psf.

c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.

d. Method CS-SFB does not apply in Seismic Design Categories D_0, D_1 and D_2 and in areas where the wind speed exceeds 100 mph.

e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D_0 through D_2 only.

R602.10.6.5 Wall bracing for dwellings with anchored stone and masonry veneer in Seismic Design Categories D0, D1 and D2. Where anchored stone and masonry veneer are installed in accordance with Section R703.7, wall bracing on exterior *braced wall lines* and *braced wall lines* on the interior of the building, backing or perpendicular to and laterally supporting anchored stone or masonry veneer ~~veneered walls~~ shall comply with this section. Where dwellings in Seismic Design Categories D0, D1 and D2 have anchored stone or masonry veneer installed in accordance with Section R703.7, and the veneer does not exceed the first-story height, wall bracing shall be in accordance with Section R602.10.3. Where detached one- or two-family dwellings in Seismic Design Categories D0, D1 and D2 have anchored stone or masonry veneer installed in accordance with Section R703.7, and the veneer exceeds the first-*story height*, wall bracing at exterior *braced wall lines* and *braced wall lines* on the interior of the building shall be constructed using Method BV-WSP in accordance with this section and Figure R602.10.6.5. Cripple walls shall not be permitted, and required interior *braced wall lines* shall be supported on continuous foundations. Townhouses in Seismic Design Categories D0, D1 and D2 with anchored stone or masonry veneer exceeding the first-story height shall be designed in accordance with accepted engineering practice.

FIGURE R602.10.6.5
METHOD BV-WSP—WALL BRACING FOR DWELLINGS WITH ANCHORED STONE AND MASONRY VENEER IN SEISMIC DESIGN CATEGORIES D0, D1 and D2

(No change to figure)

R603.9.5 Structural sheathing for anchored stone and masonry veneer. In Seismic Design Category C, where anchored stone and masonry veneer is installed in accordance with Section R703.7, the length of structural sheathing for walls supporting one *story*, roof and ceiling shall be the greater of the amount required by Section R603.9.2 or 36 percent, modified by Section R603.9.2 except Section R603.9.2.2 shall not be permitted.

Revise as follows:

R703.7 Anchored stone and masonry veneer, general. Anchored stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4 and Figure R703.7. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story* above-grade plane and shall not exceed 5 inches (127 mm) in thickness. See Section R602.10 for wall bracing requirements for anchored masonry veneer for wood-framed construction and Section R603.9.5 for wall bracing requirements for anchored masonry veneer for cold-formed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior anchored stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For detached one- or two-family *dwellings* in Seismic Design Categories D0, D1 and D2, exterior anchored stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

FIGURE R703.7
ANCHORED MASONRY VENEER WALL DETAILS

(No change to Figure)

TABLE R703.7(1)
ANCHORED STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

(Portions of Table not shown remain unchanged)

TABLE R703.7(2)
ANCHORED STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS, ONE- AND TWO-FAMILY DETACHED DWELLINGS, WOOD FRAMING, SEISMIC DESIGN CATEGORIES D0, D1 AND D2

(Portions of Table not shown remain unchanged)

R703.7.2 Exterior veneer support. Except in Seismic Design Categories D0, D1 and D2, exterior anchored masonry veneers having an installed weight of 40 pounds per square foot (195 kg/m2) or less shall be permitted to be supported on wood or cold-formed steel construction. When anchored masonry veneer supported by wood or cold-formed steel construction adjoins anchored masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood or cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the anchored masonry veneer shall be designed to limit the deflection to 1/600 of the span for the supporting members. The design of the wood or cold-formed steel construction shall consider the weight of the veneer and any other loads.

R703.7.2.1 Support by steel angle. A minimum 6 inches by 4 inches by 5/16 inch (152 mm by 102 mm by 8 mm) steel angle, with the long leg placed vertically, shall be anchored to double 2 inches by 4 inches (51 mm by 102 mm) wood studs at a maximum on-center spacing of 16 inches (406 mm). Anchorage of the steel angle at every double stud spacing shall be a minimum of two 7/16 inch (11 mm) diameter by 4 inch (102 mm) lag screws. The steel angle shall have a minimum clearance to underlying construction of 1/16 inch (2 mm). A minimum of two-thirds the width of the anchored masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the anchored masonry veneer wythe in accordance with Figure R703.7.2.1. The maximum height of anchored masonry veneer above the steel angle support shall be 12 feet, 8 inches (3861 mm). The air space separating the anchored masonry veneer from the wood backing shall be in accordance with Sections R703.7.4 and R703.7.4.2. The method of support for the anchored masonry veneer on wood construction shall be constructed in accordance with Figure R703.7.2.1.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3 inch by 3 inch by 1/4 inch (76 mm by 76 mm by 6 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as *approved* by the *building official*.

FIGURE R703.7.2.1
EXTERIOR ANCHORED MASONRY VENEER SUPPORT BY STEEL ANGLES

(No change to Figure)

R703.7.2.2 Support by roof construction. A steel angle shall be placed directly on top of the roof construction. The roof supporting construction for the steel angle shall consist of a minimum of three 2 inch by 6 inch (51 mm by 152 mm) wood members. The wood member abutting the vertical wall stud construction shall be anchored with a minimum of three 5/8-inch (16 mm) diameter by 5-inch (127 mm) lag screws to every wood stud spacing. Each additional roof member shall be anchored by the use of two

10d nails at every wood stud spacing. A minimum of two-thirds the width of the anchored masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the anchored masonry veneer wythe in accordance with Figure R703.7.2.2. The maximum height of the masonry veneer above the steel angle support shall be 12 feet, 8 inches (3861 mm). The air space separating the anchored masonry veneer from the wood backing shall be in accordance with Sections R703.7.4 and R703.7.4.2. The support for the anchored masonry veneer on wood construction shall be constructed in accordance with Figure R703.7.2.2.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3 inch by 3 inch by 1/4 inch (76 mm by 76 mm by 6 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as *approved* by the *building official*.

FIGURE R703.7.2.2
EXTERIOR ANCHORED MASONRY VENEER SUPPORT BY ROOF MEMBERS

(No change to Figure)

R703.7.3 Lintels. Anchored masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported on lintels of noncombustible materials. The lintels shall have a length of bearing not less than 4 inches (102 mm). Steel lintels shall be shop coated with a rust-inhibitive paint, except for lintels made of corrosion-resistant steel or steel treated with coatings to provide corrosion resistance. Construction of openings shall comply with either Section R703.7.3.1 or 703.7.3.2.

TABLE R703.7.3.1
ALLOWABLE SPANS FOR LINTELS SUPPORTING ANCHORED MASONRY VENEER[a, b, c, d]

(Portions of Table not shown remain unchanged)

R703.7.3.2 Maximum span. The allowable span shall not exceed 18 feet 3 inches (5562 mm) and shall be constructed to comply with Figure R703.7.3.2 and the following:

1. Provide a minimum length of 18 inches (457 mm) of anchored masonry veneer on each side of opening as shown in Figure R703.7.3.2.
2. Provide a minimum 5-inch by 31/2-inch by 5/16-inch (127 mm by 89 mm by 7.9 mm) steel angle above the opening and shore for a minimum of 7 days after installation.
3. Provide double-wire joint reinforcement extending 12 inches (305 mm) beyond each side of the opening. Lap splices of joint reinforcement a minimum of 12 inches (305 mm). Comply with one of the following:
   3.1. Double-wire joint reinforcement shall be 3/16-inch (4.8 mm) diameter and shall be placed in the first two bed joints above the opening.
   3.2. Double-wire joint reinforcement shall be 9 gauge (0.144 inch or 3.66 mm diameter) and shall be placed in the first three bed joints above the opening.
4. Provide the height of anchored masonry veneer above opening, in accordance with Table R703.7.3.2.

TABLE R703.7.3.2
HEIGHT OF ANCHORED MASONRY VENEER ABOVE OPENING

(Portions of Table not shown remain unchanged)

FIGURE R703.7.3.2
ANCHORED MASONRY VENEER OPENING

(No change to Figure)

R703.7.4 Anchorage. Anchored masonry veneer shall be anchored to the supporting wall studs with corrosion-resistant metal ties embedded in mortar or grout and extending into the veneer a minimum of 11/2 inches (38 mm), with not less than 5/8-inch (15.9 mm) mortar or grout cover to outside face. Anchored masonry veneer shall conform to Table R703.7.4.

R703.7.5 Flashing. Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels when anchored masonry veneers are designed in accordance with Section R703.7. See Section R703.8 for additional requirements.

Reason: This code change clarifies existing masonry veneer provisions which were intended to address anchored stone or masonry veneer. Historically, the IRC has used the term "masonry veneer" for provisions which apply to anchored stone or masonry veneer. This was done prior to the use of the term "adhered masonry veneer." This code change addresses all uses of the term "masonry veneer" and changes it to "anchored masonry veneer" which is the appropriate term in the current code.

Cost Impact: This code change will not increase the cost of construction.

RB372-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.7-RB-CLARK.doc

RB373 – 13
R703.7, R703.7.3

Proponent: Randall Shackelford, P.E., Simpson Strong-Tie Co., Inc. (rshackelford@strongtie.com)

Revise as follows:

R703.7 Stone and masonry veneer, general. Stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4 and Figure R703.7. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first story above-grade plane and shall not exceed 5 inches (127 mm) in thickness. <u>Masonry veneer shall not support any vertical load other than the dead load of the veneer above.</u> See Section R602.10 for wall bracing requirements for masonry veneer for wood-framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for cold-formed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

R703.7.3 Lintels. ~~Masonry veneer shall not support any vertical load other than the dead load of the veneer above.~~ Veneer above openings shall be supported on lintels of noncombustible materials. The lintels shall have a length of bearing not less than 4 inches (102 mm). Steel lintels shall be shop coated with a rust-inhibitive paint, except for lintels made of corrosion-resistant steel or steel treated with coatings to provide corrosion resistance. Construction of openings shall comply with either Section R703.7.3.1 or 703.7.3.2.

Reason: It is proposed to relocate the requirement that masonry veneer can not support imposed vertical load from the Lintel section, where it could be missed, to the general section, where it is more likely to be noticed.
The main concern is that someone building or adding to a masonry wall who is not installing lintels will not look in that section for the important requirement that masonry veneer can carry no load other than its own weight. One example of this we get is when a deck builder calls and wants help choosing an anchor to fasten a new deck to an existing brick veneer wall. They do not know they should not do this.

As further justification, one can look at ACI-530/ASCE 5/TMS402, which defines *Veneer, masonry* as "A masonry wythe that provides the exterior finish of a wall system and transfers out-of-plane load directly to a backing, but is not considered to add load resisting capacity to the wall system." Load resisting capacity could be in-plane or vertical loads.

Cost Impact: The code change proposal will not increase the cost of construction. Just relocating an existing requirement where it is more likely to be seen.

RB373-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.7-RB-SHACKELFORD.doc

RB374 – 13

Table R703.4, R703.7, R703.12

Proponent: Jason Thompson, National Concrete Masonry Association representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
					Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Horizonal aluminum[e]	Without insulation	0.019[f]	Lap	Yes	0.120 nail $1^{1}/_{2}$″ long	0.120 nail 2″ long	0.120 nail 2″ long	0.120 nail[y]	Not allowed	Same as stud spacing
		0.024	Lap	Yes	0.120 nail $1^{1}/_{2}$″ long	0.120 nail 2″ long	0.120 nail 2″ long	0.120 nail[y]	Not allowed	
	With insulation	0.019	Lap	Yes	0.120 nail $1^{1}/_{2}$″ long	0.120 nail $2^{1}/_{2}$″ long	0.120 nail $2^{1}/_{2}$″ long	0.120 nail[y]	0.120 nail $1^{1}/_{2}$″ long	
Anchored veneer: brick, concrete, masonry or stone		2	Section R703	Yes	See Section R703 and Figure R703.7[g]					
Adhered veneer: concrete, stone or masonry[w]		—	Section R703	Yes ~~Note w~~	~~See Section R703.6.1[g] or in accordance with the manufacturer's instructions.~~ <u>See Section R7803.12.</u>					
Hardboard[k] Panel siding-vertical		$^{7}/_{16}$	—	Yes	Note m	Note m	Note m	Note m	Note m	6² panel edges 12² inter. sup.[n]
Hardboard[k] Lap-siding-horizontal		$^{7}/_{16}$	Note p	Yes	Note o	Note o	Note o	Note o	Note o	Same as stud spacing 2 per bearing
Steel[h]		29 ga.	Lap	Yes	0.113 nail $1^{3}/_{4}$" Staple-$1^{3}/_{4}$"	0.113 nail $2^{3}/_{4}$" Staple-$2^{1}/_{2}$"	0.113 nail $2^{1}/_{2}$" Staple-$2^{1}/_{4}$"	0.113 nail[v] Staple[v]	Not allowed	Same as stud spacing
Particleboard panels		$^{3}/_{8}$ - $^{1}/_{2}$	—	Yes	6d box nail (2″ × 0.099″)	6d box nail (2″ × 0.099″)	6d box nail (2″ × 0.099″)	box nail[v]	6d box nail (2″ × 0.099″), $^{3}/_{8}$ not allowed	6″ panel edge, 12" inter. sup.
		$^{5}/_{8}$	—	Yes	6d box nail (2″ × 0.099″)	8d box nail ($2^{1}/_{2}$″ × 0.113″)	8d box nail ($2^{1}/_{2}$″ × 0.113″)	box nail[v]	6d box nail (2″" × 0.099″)	
Wood structural panel[i] ANSI/APA-PRP 210 siding[i] (exterior grade)		$^{3}/_{8}$ - $^{1}/_{2}$	Note p	Yes	0.099 nail-2"	0.113 nail-$2^{1}/_{2}$"	0.113 nail-2 ½"	0.113 nail[v]	0.099 nail-2²	6" panel edges, 12" inter. sup.
Wood structural panel lapsiding		$^{3}/_{8}$ - $^{1}/_{2}$	Note p Note x	Yes	0.099 nail-2"	0.113 nail-$2^{1}/_{2}$"	0.113 nail-2 ½"	0.113 nail[x]	0.099 nail-2"	8″ along bottom edge

Vinyl siding[l]	0.035	Lap	Yes	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y, z]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not allowed	16 inches on center or specified by the manufacturer instructions or test report
Wood[j] rustic, drop	$^{3}/_{8}$ Min	Lap	Yes	Fastener penetration into stud-1”				0.113 nail-$2^{1}/_{2}$” Staple-2”	Face nailing up to 6” widths, 1 nail per bearing; 8” widths and over, 2 nails per bearing
Shiplap	$^{19}/_{32}$ Average	Lap	Yes	Fastener penetration into stud-1”				0.113 nail-$2^{1}/_{2}$” Staple-2”	Face nailing up to 6” widths, 1 nail per bearing; 8” widths and over, 2 nails per bearing
Bevel	$^{7}/_{16}$								
Butt tip	$^{3}/_{16}$	Lap	Yes						
Fiber cement panel siding[q]	$^{5}/_{16}$	Note q	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	4d common corrosion-resistant nail[r]	6” o.c. on edges, 12” o.c. on intermed. studs
Fiber cement lap siding[s]	$^{5}/_{16}$	Note s	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	6d common corrosion-resistant nail or 11-gage roofing nail[r]	Note t

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.

b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.

c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.

d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.

e. Aluminum nails shall be used to attach aluminum siding.

f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.

g. All attachments shall be coated with a corrosion-resistant coating.

h. Shall be of approved type.

i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.

j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.

k. Hardboard siding shall comply with CPA/ANSI A135.6.

l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^1/_2$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
~~w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.~~
~~x~~ w. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
~~y~~ y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.

R703.7 Anchored stone and masonry veneer, general. Anchored stone and masonry veneer shall be installed in accordance with this chapter, Table R703.4 and Figure R703.7. These veneers installed over a backing of wood or cold-formed steel shall be limited to the first *story* above-grade plane and shall not exceed 5 inches (127 mm) in thickness. See Section R602.10 for wall bracing requirements for masonry veneer for wood-framed construction and Section R603.9.5 for wall bracing requirements for masonry veneer for cold-formed steel construction.

Exceptions:

1. For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.
2. For detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

R703.12 Adhered masonry veneer ~~installation~~. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and the requirements in Sections 6.1 and 6.3 of TMS 402/ACI 530/ASCE 5. Adhered masonry veneer shall be installed in accordance with Section R703.6.1, Article 3.3 C of TMS 602/ACI 530.1/ASCE 6, or the manufacturer's instructions.

Reason: The changes proposed consolidate and clarify the requirements for adhered masonry veneer into Section R703.12. Sections 6.1 and 6.3 of TMS 402 list prescriptive requirements for adhered veneers; such as weight limits and minimum adhesion strength between the adhered veneer and its backing. Section R703.6.3 defines minimum water-resistive barrier requirements.

The footnote w to Table R703.4 is proposed to be deleted and these requirements are incorporated into Section 703.12 where they are less likely to be overlooked. The method of installing adhered veneer varies depending upon the substrate to which it is bonded. For wood sheathing, metal lathe is used in accordance with R703.6.1. For concrete or masonry backing, Article 3.3 C of TMS 602 details prescriptive installation requirements.

The term 'anchored' is proposed to be added to the charging language of Section R703.7 to help clarify and differentiate these requirements from those for adhered veneer.

Cost Impact: This code change will not increase the cost of construction.

RB374-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB375 – 13

Table R703.4, R703.7, R703.7.2, R703.7.2.1 (NEW), R703.7.2.2 (NEW), R703.12, R703.12.1, R703.12.2

Proponent: Suzanne Kusik, PE, CBO; Orange Empire Chapter Code Committee

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
					Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Horizonal aluminum[e]	Without insulation	0.019[f] 0.024	Lap	Yes	0.120 nail $1^1/_2$″ long	0.120 nail 2″ long	0.120 nail 2″ long	0.120 nail[y]	Not allowed	Same as stud spacing
			Lap	Yes	0.120 nail $1^1/_2$″ long	0.120 nail 2″ long	0.120 nail 2″ long	0.120 nail[y]	Not allowed	
	With insulation	0.019	Lap	Yes	0.120 nail $1^1/_2$″ long	0.120 nail $2^1/_2$″ long	0.120 nail $2^1/_2$″ long	0.120 nail[y]	0.120 nail $1^1/_2$” long	
Anchored veneer: brick, concrete, masonry or stone		~~2~~ Section R703.7 and Tables R703.7(1) & R703.7(2)	Section R703	Yes	See Section ~~R703~~ R703.7 and Figure R703.7[g]					
Adhered veneer: concrete, stone or masonry[w]		— Section R703.7	Section R703	Yes Note w	See Section ~~R703.6.1[g]~~ R703.7[g] or in accordance with the manufacturer's instructions.					
Hardboard[k] Panel siding-vertical		$^7/_{16}$	—	Yes	Note m	Note m	Note m	Note m	Note m	6² panel edges 12² inter. sup.[n]
Hardboard[k] Lap-siding-horizontal		$^7/_{16}$	Note p	Yes	Note o	Note o	Note o	Note o	Note o	Same as stud spacing 2 per bearing
Steel[h]		29 ga.	Lap	Yes	0.113 nail $1^3/_4$” Staple-$1^3/_4$”	0.113 nail $2^3/_4$” Staple-$2^1/_2$”	0.113 nail $2^1/_2$” Staple-$2^1/_4$”	0.113 nail[v] Staple[v]	Not allowed	Same as stud spacing
Particleboard panels		$^3/_8$ - $^1/_2$	—	Yes	6d box nail (2″ × 0.099″)	6d box nail (2″ × 0.099″)	6d box nail (2″ × 0.099″)	box nail[v]	6d box nail (2″ × 0.099″), $^3/_8$ not allowed	6″ panel edge, 12" inter. sup.
		$^5/_8$	—	Yes	6d box nail (2″ × 0.099″)	8d box nail ($2^1/_2$″ × 0.113″)	8d box nail ($2^1/_2$″ × 0.113″)	box nail[v]	6d box nail (2″" × 0.099″)	
Wood structural panel[i] ANSI/APA-PRP 210 siding[i] (exterior grade)		$^3/_8$ - $^1/_2$	Note p	Yes	0.099 nail-2”	0.113 nail-$2^1/_2$"	0.113 nail-2 ½”	0.113 nail[v]	0.099 nail-2²	6” panel edges, 12” inter. sup.

Wood structural panel lapsiding	$^{3}/_{8}$ - $^{1}/_{2}$	Note p Note x	Yes	0.099 nail-2”	0.113 nail-2$^{1}/_{2}$”	0.113 nail-2 ½”	0.113 nail[x]	0.099 nail-2”	8″ along bottom edge
Vinyl siding[l]	0.035	Lap	Yes	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y, z]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not allowed	16 inches on center or specified by the manufacturer instructions or test report
Wood[j] rustic, drop	$^{3}/_{8}$ Min	Lap	Yes	Fastener penetration into stud-1”				0.113 nail-2$^{1}/_{2}$” Staple-2”	Face nailing up to 6” widths, 1 nail per bearing; 8” widths and over, 2 nails per bearing
Shiplap	$^{19}/_{32}$ Average	Lap	Yes	Fastener penetration into stud-1”				0.113 nail-2$^{1}/_{2}$” Staple-2”	Face nailing up to 6” widths, 1 nail per bearing; 8” widths and over, 2 nails per bearing
Bevel	$^{7}/_{16}$								
Butt tip	$^{3}/_{16}$	Lap	Yes						
Fiber cement panel siding[q]	$^{5}/_{16}$	Note q	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	4d common corrosion-resistant nail[r]	6” o.c. on edges, 12” o.c. on intermed. studs
Fiber cement lap siding[s]	$^{5}/_{16}$	Note s	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	6d common corrosion-resistant nail or 11-gage roofing nail[r]	Note t

SIDING MATERIAL		NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
					Wood or wood structural panel sheathing into stud	**Fiberboard sheathing into stud**	**Gypsum sheathing into stud**	**Foam plastic sheathing into stud**	**Direct to studs**	**Number or spacing of fasteners**
Horizonal aluminum[e]	Without insulation	0.019[f] 0.024	Lap	Yes	0.120 nail 1$^{1}/_{2}$” long	0.120 nail 2^{2} long	0.120 nail 2^{2} long	0.120 nail[y]	Not allowed	Same as stud spacing
			Lap	Yes	0.120 nail 1$^{1}/_{2}$” long	0.120 nail 2” long	0.120 nail 2^{2} long	0.120 nail[y]	Not allowed	
	With insulation	0.019	Lap	Yes	0.120 nail 1$^{1}/_{2}$” long	0.120 nail 2$^{1}/_{2}$” long	0.120 nail 2$^{1}/_{2}$^{2} long	0.120 nail[y]	0.120 nail 1$^{1}/_{2}$^{2} long	

Anchored veneer: brick, concrete, masonry or stone	~~2~~	Section R703	Yes	See Section R~~703~~ 703.7 and Figure R703.7[g]						
Adhered veneer: concrete, stone or masonry[w]	— Section R703.7	Section R703	Yes Note w	See Section ~~R703.6.1[g]~~ R703.7 or in accordance with the manufacturer's instructions.						
Hardboard[k] Panel siding-vertical	$^{7}/_{16}$	—	Yes	Note m	Note m	Note m	Note m	Note m	6² panel edges 12² inter. sup.[n]
Hardboard[k] Lap-siding-horizontal	$^{7}/_{16}$	Note p	Yes	Note o	Note o	Note o	Note o	Note o	Same as stud spacing 2 per bearing
Steel[h]	29 ga.	Lap	Yes	0.113 nail $1^{3}/_{4}$² Staple-$1^{3}/_{4}$²	0.113 nail $2^{3}/_{4}$² Staple-$2^{1}/_{2}$²	0.113 nail $2^{1}/_{2}$² Staple-$2^{1}/_{4}$²	0.113 nail[v] Staple[v]	Not allowed	Same as stud spacing
Particleboard panels	$^{3}/_{8}$ - $^{1}/_{2}$	—	Yes	6d box nail (2² × 0.099²)	6d box nail (2² × 0.099²)	6d box nail (2² × 0.099²)	box nail[v]	6d box nail (2² × 0.099²), $^{3}/_{8}$ not allowed	6² panel edge, 12" inter. sup.
	$^{5}/_{8}$	—	Yes	6d box nail (2² × 0.099²)	8d box nail ($2^{1}/_{2}$² × 0.113²)	8d box nail ($2^{1}/_{2}$² × 0.113²)	box nail[v]	6d box nail (2²" × 0.099²)	
Wood structural panel[i] ANSI/APA-PRP 210 siding[i] (exterior grade)	$^{3}/_{8}$ - $^{1}/_{2}$	Note p	Yes	0.099 nail-2²	0.113 nail-$2^{1}/_{2}$²	0.113 nail-2 $^{1}/_{2}$²	0.113 nail[v]	0.099 nail-2²	6² panel edges, 12² inter. sup.
Wood structural panel lapsiding	$^{3}/_{8}$ - $^{1}/_{2}$	Note p Note x	Yes	0.099 nail-2²	0.113 nail-$2^{1}/_{2}$²	0.113 nail-2 $^{1}/_{2}$²	0.113 nail[x]	0.099 nail-2²	8² along bottom edge
Vinyl siding[l]	0.035	Lap	Yes	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y, z]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head or 16-gage staple with $^{3}/_{8}$ to $^{1}/_{2}$-inch crown[y]	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not allowed	16 inches on center or specified by the manufacturer instructions or test report
Wood[j] rustic, drop	$^{3}/_{8}$ Min	Lap	Yes	Fastener penetration into stud-1²				0.113 nail-$2^{1}/_{2}$² Staple-2²	Face nailing up to 6² widths, 1 nail per bearing; 8² widths and over, 2 nails per bearing
Shiplap	$^{19}/_{32}$ Average	Lap	Yes	Fastener penetration into stud-1²				0.113 nail-$2^{1}/_{2}$² Staple-2²	Face nailing up to 6² widths, 1 nail per bearing; 8² widths and over, 2 nails per bearing
Bevel	$^{7}/_{16}$								
Butt tip	$^{3}/_{16}$	Lap	Yes						

Fiber cement panel siding[q]	$^5/_{16}$	Note q	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	4d common corrosion-resistant nail[r]	6^2 o.c. on edges, 12^2 o.c. on intermed. studs
Fiber cement lap siding[s]	$^5/_{16}$	Note s	Yes Note u	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r]	6d common corrosion-resistant nail[r, v]	6d common corrosion-resistant nail or 11-gage roofing nail[r]	Note t

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^7/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^1/_2$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^1/_2$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^1/_2$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.
x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.

R703.7 Stone and masonry veneer, general. Stone and masonry anchored or adhered veneer shall be installed in accordance with this chapter, Table R703.4, Table R703.7(1), Table R703.7(2) and Figure R703.7. ~~These veneers installed over a backing of wood or cold formed steel shall be limited to the first story above-grade plan and shall not exceed 5 inches in thickness.~~ Wall bracing for stone and masonry veneer shall comply with ~~See~~ Section R602.10 ~~for wall bracing requirement~~ for masonry veneer for wood framed construction and R603.9.5 ~~for wall bracing requirement~~ for masonry veneer for cold-formed steel construction.

~~**Exceptions:**~~

1. ~~For all buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.7(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation.~~

2. ~~For detached one- or two-family *dwellings* in Seismic Design Categories D_0, D_1 and D_2, exterior stone or masonry veneer, as specified in Table R703.7(2), with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.~~

R703.7.2 Anchored exterior veneer. Stone or masonry veneer greater than 2 ⅝ inches nominal thickness or with an installed unit weight greater than 15 pounds per square feet shall be installed as anchored veneer in accordance with this chapter.

R703.7.2.1 Exterior anchored veneer supported by a noncombustible foundation. All buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer with backing of wood or steel framing shall be permitted to the height specified in Table R703.7(1) above a noncombustible foundation. Detached one- or two-family dwellings in Seismic Design Categories D_0, D_1, and D_2, exterior stone or masonry veneer with a backing of wood framing shall be permitted to the height specified in Table R703.7(2) above a noncombustible foundation.

R703.7.2.2 Exterior anchored veneer supported by wood or cold-formed steel construction. ~~Except in Seismic Design Categories D_0, D_1, and D_2, e~~Exterior masonry veneers having an installed weight of 40 pounds per square foot or less shall be permitted to be supported on wood or cold-formed steel construction When masonry veneer supported by wood or cold-formed steel construction adjoins masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood or cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the masonry veneer shall be designed to limit the deflection to $^1/_{600}$ of the span for the supporting members. The design of the wood or cold-formed steel construction shall consider the weight of the veneer and any other loads.

> **Exception:** In Seismic Design Categories D_0, D_1, and D_2, exterior anchored veneer shall not be permitted to be supported on wood or cold-formed steel construction.

~~**R703.12**~~ **R703.7.3 Adhered ~~masonry~~ exterior veneer installation.** Adhered stone and masonry veneer shall be installed in accordance with this chapter, Table 703.4 and the manufacturer's instructions. Adhered veneer shall not exceed 2 ⅝ inches nominal thickness and 15 pounds per square feet maximum installed unit weight.

~~**R703.12.1**~~ **R703.7.3.1 Clearances.** On exterior stud walls, adhered masonry veneer shall be installed:

1. Minimum of 4 inches (102 mm) above the earth;
2. Minimum of 2 inches (51 mm) above paved areas; or
3. Minimum of $^1/_2$ inch (12 mm) above exterior walking surfaces which are supported by the same foundation that supports the exterior wall.

~~**R703.12.2**~~ **R703.7.3.2 Flashing at foundation.** A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48 mm) or 26-gage galvanized or plastic with a minimum vertical attachment flange of $3^1/_2$ inches (89 mm) shall be installed to extend a minimum of 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section R703.8. The water-resistant barrier, ~~as required by Table R703.4, Footnote w~~, shall comply with Section R703.6.3 and lap over the exterior of the attachment flange of the screed or flashing.

Reason: The overall propose of this change is to consolidate the anchored and adhered veneer installation requirements to one place, by following the siding material sequence established in Table 703.4. Currently the code requirements for adhered veneer are buried in table footnotes; other standards not typically utilized by one- and two-family builders and designers; or, are lost behind the vinyl siding requirements at the end of the Wall Coverings Chapter.

ITEM 1: Corrects the material thicknesses, and anchorage requirements to agree with the remaining code sections and details. The proposed reference to the appropriate tables takes into consideration the differing veneer thicknesses allowed in various Seismic Design Categories.

ITEM 2: This change provides more accurate and descriptive Section titles and relocates code requirements from existing Exceptions, to renumbered sections.

ITEM 3: Adds specific thickness and unit weight requirements for when veneer must be anchored. The code is currently silent on this requirement.

ITEM 4: This item relocates the adhered veneer requirements from the end of the chapter to after the anchored veneer requirements, in keeping with Table 703.4 order of materials, and consolidates requirements for similar exterior wall covering materials. The change also quantifies the maximum allowable veneer thickness and unit weight of adhered veneer.

ITEM 5: A missing cross reference was added to correlate with related code sections; and the sentence grammar was corrected.

Cost Impact: The code change proposal will not increase the cost of construction.

RB375-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB376 – 13
Figure R703.7

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

FIGURE R703.7
<u>TYPICAL</u> MASONRY VENEER WALL DETAILS

For SI: 1 inch = 25.4 mm.
a. See Sections R703.7.5, R703.7.6 and R703.8.
b. See Sections R703.2 and R703.7.4.
c. See Section R703.7.4.2 and Table R703.7.4.
d. See Section R703.7.3.
<u>e. Figure R703.7 illustrates typical construction details for a masonry veneer wall. For the actual mandatory requirements of the code, see the indicated sections of text. Other details of masonry veneer wall construction shall be permitted provided the requirements of the indicated sections of text met.</u>

(No change to Figure)

Reason: The purpose of this code change is to address potential misapplication of, and particularly improper enforcement of, the masonry veneer wall details. The existing details do not capture all of the possible window head, window sill, and foundation details which can occur in a masonry veneer wall assembly. For example, the current head and sill detail shows a wood window aligned within the wall studs, yet most windows installed today are vinyl, and in many cases the actual window sashes, panes, etc. are outboard of the stud wall. Similarly, most builders provide one course of CMU, or step back the top of a concrete wall, such that floor framing bears far enough above grade to avoid decay resistance requirements. As currently shown, not only the sill plate, but the floor joists, wall studs, and wall sheathing would all need to be preservative-treated or of naturally decay-resistant species because they would not meet the clearances of Section R317.

By retitling both portions of the detail as "typical" and adding the proposed footnote, the code will be clear that the veneer wall details are somewhat schematic, and that it is the code provisions (or, where applicable, manufacturer's instructions for windows, flashing and other elements) that provide the mandatory requirements. This is in keeping with similar titles and notes in other sections of the code, such as Figures R602.3(1), R613.8, and P2903.10 (for "typical") and Table R703.7.3.1 or Figures B-11 and B-12 for the note. The specific text of the note mirrors the note provided with Table R1001.1 for masonry fireplaces and chimneys.

Cost Impact: The code change proposal will not increase the cost of construction.

RB376-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB377 – 13
R703.8

Proponent: Jeff Inks, Window and Door Manufacturers Association, Theresa A. Weston, PhD., Dupont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.8 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. ~~Self-adhered membranes used as flashing shall comply with AAMA 711.~~ The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. <u>Self-adhered membranes used as flashing shall comply with AAMA 711.</u> Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   1.2. In accordance with the flashing design or method of a registered design professional.
   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason: (INKS) The charging paragraph of Section 703.8 is applicable to all seven locations listed below it. The provision requiring self-adhered membrane used as flashing to comply with AAMA 711 is applicable only to fenestration products (*Voluntary Specification for Self-adhering Flashing Used for Installation of Exterior Wall Fenestration Products*) and is therefore incorrectly located in the charging paragraph. This proposal simply moves the verbatim provision to the proper location in number 1 – Exterior window and door openings.
(WESTON) This proposal moves the reference standard for self-adhered flashing (AAMA 711) to the section specific to window and door openings from the more general flashing section. This would clarify the appropriate use of the referenced standard and provide consistency with the scope of AAMA 711: "*This voluntary specification establishes minimum performance requirements for self adhering flashing surrounding exterior wall fenestration produducts*".

Cost Impact: This code change proposal will not increase the cost of construction.

RB377-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.8-RB-INKS-WESTON.doc

RB378 – 13
R703.8, Chapter 44

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. <u>Mechanically attached flexible flashings shall comply with AAMA 712.</u> Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
    1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
    1.2. In accordance with the flashing design or method of a registered design professional.
    1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Add new standard to Chapter 44 as follows:

AAMA

<u>AAMA 712-11Voluntary Specification for Mechanically Attached Flexible Flashing</u>

Reason: This proposal will add new requirements to the code for mechanically attached flexible flashing materials. Water entry at interfaces, including those around fenestration, has been a significant cause of construction defects. Setting minimum standards for the materials used at these interfaces is important to the durability of construction. Material property/performance requirements are currently included in the code only for self-adhered flashings, but should also be included for other types of systems. AAMA 712 was developed by industry to insure that mechanically attached flexible flashing materials meet minimum performance specifications. This proposal incorporates this industry standard by reference into the code. The properties and quality of flashing materials are crucial to successful implementation of the water management in wall systems.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AAMA 712 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB378-13

Public Hearing:	Committee:	AS	AM	D

Assembly: ASF AMF DF

RB379 – 13
R703.8, Chapter 44

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. <u>Fluid applied membranes used as flashing shall comply with AAMA 714.</u> Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   1.2. In accordance with the flashing design or method of a registered design professional.
   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Add new standard to Chapter 44 as follows:

AAMA

<u>AAMA 714-12 Voluntary Specification for Liquid Applied Flashing Used to Create a Water-Resistive Seal around Exterior Wall Openings in Buildings</u>

Reason: This proposal will add new requirements to the code for fluid –applied membranes used as flashing materials. Water entry at interfaces, including those around fenestration, has been a significant cause of construction defects. Setting minimum standards for the materials used at these interfaces is important to the durability of construction. Material property/performance requirements are currently included in the code only for self-adhered flashings, but should also be included for other types of systems. AAMA 714, was developed by industry to insure that fluid-applied material meet minimum performance specifications. This proposal incorporates this industry standard by reference into the code. The properties and quality of flashing materials are crucial to successful implementation of the water management in wall systems.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, AAMA 714 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB379-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.8 #2-RB-WESTON.doc

RB380 – 13
R703.8

Proponent: James D. Katsaros, DuPont Building Innovations (james.d.katsaros@dupont.com)

Revise as follows:

R703.8 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier <u>complying with Section 703.2</u> for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   1.2. In accordance with the flashing design or method of a registered design professional.
   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason: This proposal provides a pointer to the code section which specifies water-resistive barriers and their installation. Because the flashing integration with the water-resistive barrier is critical to the performance of the envelope system, it is critical that the water-resistive barrier is installed correctly. This pointer, while not changing the existing code requirements, will add emphasis to the criticality of integration and performance of the entire system.

Correct installation and integration of flashing and water-resistive barrier systems is a significant cause of moisture related construction defects. A recent study (K.R. Grosskopf, P. Oppenheim and T. Brennan, "Preventing Defect Claims In Hot, Humid Climates" ASHRAE Journal, July 2008) reported "*findings from participants who were involved in more than 17,000 combined total construction defect claims indicate that 84% of claims are associated with moisture-related defects in building envelope systems (69%) and building mechanical systems (15%). More than half (53%) of all defects are caused by faulty installation.*"

Cost Impact: The code change proposal will not increase the cost of construction.

RB380-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.8 #4-RB-WESTON.doc

RB381 – 13

R703.9, R703.9.1, R703.9.2, R703.9.2.1, R703.9.2.2, R703.9.3, R703.9.4, R703.9.4.1, R703.9.4.2

Proponent: Jesse J Beitel, Hughes Associates, Inc. representing EIFS Industry Members Association

Revise as follows:

R703.9 Exterior insulation and finish system (EIFS)/EIFS with drainage. Exterior Insulation and Finish Systems (EIFS) shall comply with this chapter and Section~~s~~ R703.9.1. ~~and R703.9.3~~. EIFS with drainage shall comply with this chapter and Section~~s~~ R703.9.2~~, R703.9.3 and R703.9.4~~.

R703.9.1 Exterior insulation and finish systems (EIFS). EIFS shall comply with ~~ASTM E 2568.~~ all of the following:

1. EIFS shall comply with ASTM E 2568.
2. EIFS shall be limited to applications over concrete or masonry wall assemblies (substrates).
3. Flashing of EIFS shall be provided in accordance with the requirements of Section R703.8.
4. EIFS shall be installed in accordance with the manufacturer's installation instructions.
5. The EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level.
6. Decorative trim shall not be face nailed through the EIFS.

R703.9.2 Exterior insulation and finish system (EIFS) with drainage. EIFS with drainage shall comply with all of the following: ~~ASTM E 2568 and shall have an average minimum drainage efficiency of 90 percent when tested in accordance with ASTM E 2273.~~

1. EIFS with drainage shall comply with ASTM E 2568.
2. EIFS with drainage shall be required over all wall assemblies with the exception of concrete and masonry wall assemblies (substrates).
3. EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance with ASTM E 2273.
4. The water-resistive barrier shall comply with Section R703.2 or ASTM E 2570.
5. The water-resistive barrier shall be applied between the EIFS and the wall sheathing.
6. Flashing of EIFS with drainage shall be provided in accordance with the requirements of Section R703.8.
7. EIFS with drainage shall be installed in accordance with the manufacturer's installation instructions.
8. The EIFS with drainage shall terminate not less than 6 inches (152 mm) above the finished ground level.
9. Decorative trim shall not be face nailed through the EIFS with drainage.

~~**R703.9.2.1 Water-resistive barrier.** The water-resistive barrier shall comply with Section R703.2 or ASTM E 2570.~~

~~**R703.9.2.2 Installation.** The water-resistive barrier shall be applied between the EIFS and the wall sheathing.~~

~~**R703.9.3 Flashing, general.** Flashing of EIFS shall be provided in accordance with the requirements of Section R703.8.~~

~~**R703.9.4 EIFS/EIFS with drainage installation.** All EIFS shall be installed in accordance with the manufacturer's installation instructions and the requirements of this section.~~

~~**R703.9.4.1 Terminations.** The EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level.~~

~~**R703.9.4.2 Decorative trim.** Decorative trim shall not be face nailed though the EIFS.~~

Reason: When the EIFS section was added to the IRC in the 2009 edition, it was industry's position that EIFS (also known as "barrier" EIFS or EIFS without drainage) would be limited to applications over concrete or masonry substrates. It was also the industry's intent that EIFS with drainage shall be required on framed/sheathed walls constructed under the IRC. These applications were and still are consistent with the ICC Evaluation Service Reports for these products.

In examining the the existing Code text, it appears that the industry's intent may not be clear. For example, in Section 703.1.1, Exception 2 allows an "opt out" for the need for a means of drainage in the exterior wall envelope if it can meet the requirements of ASTM E331. Thus, while an EIFS "barrier" system could meet this requirement, the industry does not recommend this application on residential framed/sheathed construction. This restriction is consistent with the various EIFS manufacturer's ICC-ES Reports.

Thus, the proposed Code proposal provides clear language that addresses this potential issue.

Additionally, upon review of the existing Code section, there appears to be several areas that were unclear as to the requirements for the EIFS and/or the EIFS with drainage. As such, the section has been reordered so as to provide clarity for the requirements of each type of EIFS.

Cost Impact: The code change proposal will not increase the cost of construction.

RB381-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.9-RB-BEITEL.doc

RB382 – 13
R703.10.1, Chapter 44

Proponent: John Mulder, Intertek Testing Services NA, Inc., representing International Standards Organization Technical Committee 77, *Products in Fibre-reinforced Cement* and self

Revise as follows:

R703.10.1 Panel siding. Fiber-cement panels shall comply with the requirements of ASTM C 1186, Type A, minimum Grade II <u>or ISO 8336, Category A, minimum Class 2</u>. Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be sealed with caulking, covered with battens or shall be designed to comply with Section R703.1. Panel siding shall be installed with fasteners according to Table R703.4 or *approved* manufacturer's installation instructions.

Add new standard to Chapter 44 as follows:

ISO

<u>8336 – Fibre-Cement Flat Sheets – Product Specification and Test Methods</u>

Reason: Performance requirements of ISO 8336, *Fibre-cement flat sheets – Product specification and test methods*, have been harmonized with the performance requirements of ASTM C1186, *Standard Specification for Flat Non-Asbestos Fiber-Cement Sheets*. Fiber-cement siding producers in Mexico, Central and South America, Europe, Asia, Australia and New Zealand currently manufacture and test their fiber-cement siding products for compliance with ISO 8336. The inclusion of this Standard reference in the IBC will permit manufacturers worldwide to demonstrate product compliance to IBC requirements. The addition of a reference to ISO 8336 in the Code removes a barrier to trade. Additional editorial changes are proposed to clarify the nature of the required vertical and/or horizontal joint protection to include reference to *approved* caulking and the recognition of both vertical or horizontal shiplap joints as a means of protecting the joints as is also common with wood panel siding.

IBC Section 1405.16.1 has, as a result of the IBC Group A Code Hearings, been revised to adopt this additional Standards reference (see attached Committee Action). This proposed revision brings the two building codes (IBC & IRC) and the applicable code sections and standards references into general alignment.

Cost Impact: The code change proposal will not increase the cost of construction because the product is already recognized for use in the Code. Reference to compliance with this alternative standard, an International Standard requiring the same performance as the ASTM Standard, will reduce barriers to trade by allowing foreign products complying with ISO 8336, Category A, minimum Class 2, market access to the United States without the need for additional product compliance documentation.

Analysis: A review of the standard proposed for inclusion in the code, ISO 8336 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB382-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.10.1-RB-MULDER.doc

RB383 – 13
R202 (NEW), Table R703.4, R703.11.1.1, R703.11.1.2 (NEW), R703.11.1.3 (NEW)

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

For SI: 1 inch = 25.4 mm.

y. Minimum fastener length must ~~accommodate~~ be sufficient to penetrate sheathing other nailable substrate and ~~penetrate~~ framing ~~0.75 inches~~ a total of a minimum of 1 ¼ inches or in accordance with the manufacturer's installation instructions.

z. ~~Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.~~ Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report, without penetrating into framing.

(Portions of Table not shown remain unchanged)

R703.11.1.1 Fasteners. Unless specified otherwise by the manufacturer's instructions, fasteners for vinyl siding shall be 0.120 shank diameter nail with a 0.313 head or 16 gauge staple with a 3/8 to 1/2-inch crown.

R703.11.1.2 Penetration Depth. Unless specified otherwise by the manufacturer's instructions, fasteners shall penetrate into building framing. The total penetration into sheathing, furring framing or other nailable substrate shall be 1-1/4 inches. Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report, without penetrating into framing. Where the fastener penetrates fully through the sheathing, the end of the fastener shall extend a minimum of ¼ inch beyond the opposite face of the sheathing or nailable substrate.

R703.11.1.3 Spacing. Unless specified otherwise by the manufacturer's instructions, the maximum spacing between fasteners for horizontal siding shall be 16 inches, and for vertical siding 12 inches both horizontally and vertically. Where specified by the manufacturer's instructions and supported by a test report, greater fastener spacing is permitted.

~~R703.11.1.1~~ R703.11.1.4 Vinyl soffit panels. Soffit panels shall be individually fastened to a supporting component such as a nailing strip, fascia or subfascia component or as specified by the manufacturer's instructions.

Add new definition as follows:

NAILABLE SUBSTRATE. A product or material such as framing, sheathing, or furring, composed of wood or wood-based materials, or other materials and fasteners providing equivalent fastener withdrawal resistance under transverse load.

Reason: Currently information on vinyl siding fastener specifications, penetration, and spacing is found only in Table 703.4 and its footnotes. The first purpose of this proposal is to place those requirements into code text where they are more easily found and can be more clearly stated.

The second reason is to ensure that certain requirements, which have been implied but not explicitly stated in the codes, are included. Vinyl siding can be used in conjunction with a variety of sheathing types, some of which contribute to resisting fastener withdrawal, and some which don't. It is necessary to ensure that, regardless of the sheathing type, the total penetration into a material capable of holding fasteners is equivalent to what was used during testing of the siding. For typical siding installations, this is ¾ inch into framing plus approximately ½ inch through wood sheathing, for a total of 1-1/4 inch of penetration into "nailable" material. This minimum penetration would be required unless a different penetration is specified in the manufacturer's instructions. A definition of "nailable substrate" is added to define what is considered to be "nailable".

Where the siding is used over a non-nailable material, then the total penetration must still be achieved, in this case by using a fastener long enough to accommodate the thickness of non-nailable material and penetrate the full 1-1/4 inches into framing or a combination of framing and other nailable material. By stating the requirement in terms of the total required penetration, rather than only in terms of framing penetration, it should be clear what penetration is needed for all installations.

This is not a new requirement, but needs to be more explicitly stated. The definition of nailable substrate and requirement for minimum total penetration into nailable substrate have already been added to several ICC-ES Evaluation Reports.

In addition to the above, the maximum fastener spacing for both horizontal and vertical siding has been added to the code text. The IRC previously had no provision for fastener spacing for vertical siding; the proposed requirement is the same as that currently in the IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB383-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.11.1.1 (NEW)-RB-DOBSON.doc

RB384 – 13
R703.11.2, R703.11.2.1, R703.11.2.2

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R703.11.2 Vinyl siding used with ~~F~~foam plastic sheathing. Vinyl siding used with foam plastic sheathing shall be installed in accordance with Section R703.11.2.1, R703.11.2.2, or R703.11.2.3.

R703.11.2.1 ~~Exception:~~ Where the foam plastic sheathing is applied directly over wood structural panels, fiberboard, gypsum sheathing or other *approved* backing capable of independently resisting the design wind pressure, the vinyl siding shall be installed in accordance with Section R703.11.1.

~~**R703.11.2.1 Basic wind speed not exceeding 90 miles per hour and Exposure Category B.** Where the basic wind speed does not exceed 90 miles per hour (40 m/s), the Exposure Category is B and gypsum wall board or equivalent is installed on the side of the wall opposite the foam plastic sheathing, the minimum siding fastener penetration into wood framing shall be 11/4 inches (32 mm) using minimum 0.120-inch diameter nail (shank) with a minimum 0.313-inch diameter head, 16 inches on center. The foam plastic sheathing shall be minimum 1/2-inch-thick (12.7 mm) (nominal) extruded polystyrene per ASTM C 578, 1/2-inch-thick (12.7 mm) (nominal) polyisocyanurate per ASTM C 1289, or 1-inch-thick (25 mm) (nominal) expanded polystyrene per ASTM C 578.~~

~~**R703.11.2.2 Basic wind speed exceeding 90 miles per hour or Exposure Categories C and D.** Where the basic wind speed exceeds 90 miles per hour (40 m/s) or the Exposure Category is C or D, or all conditions of Section R703.11.2.1 are not met, the adjusted design pressure rating for the assembly shall meet or exceed the loads listed in Tables R301.2(2) adjusted for height and exposure using Table R301.2(3). The design wind pressure rating of the vinyl siding for installation over solid sheathing as provided in the vinyl siding manufacturer's product specifications shall be adjusted for the following wall assembly conditions:~~

1. ~~For wall assemblies with foam plastic sheathing on the exterior side and gypsum wall board or equivalent on the interior side of the wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.39.~~
2. ~~For wall assemblies with foam plastic sheathing on the exterior side and no gypsum wall board or equivalent on the interior side of wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.27.~~

R703.11.2.2 Where the foam plastic sheathing is installed directly over studs and the foam plastic sheathing attachment is not designed to separately resist 100% of the wind load, the design wind pressure rating of the vinyl siding shall be multiplied by 0.27 and the result shall not be less than the design wind pressure load as determined in Section 703.1.2. The vinyl siding shall be installed in accordance with the manufacturer's instructions for the design wind pressure resistance rating.

> **Exception:** For conditions where the design wind suction load as determined in Section 703.1.2 does not exceed 30 psf and the interior surface of the wall is sheathed with 1/2-in gypsum wallboard or equivalent, the design wind pressure rating of the vinyl siding shall be permitted to be multiplied by 0.30 rather than 0.27.

Reason: The proposed revisions intend to bring provisions for use of vinyl siding to secure foam plastic sheathing to resist wind suction loads more in line with requirements for sheathing products used structurally for wind resistance. Specifically, revisions are based on an assumption that the same wind suction loads applicable for securing exterior structural sheathing products to wall studs (i.e. either 100% or 90% of the wind suction loads) are also applicable for vinyl siding securing foam plastic sheathing to studs.

The following revisions are implemented: 1) removal of the 90 mph and less wind speed provisions of 703.11.2 due to inadequate wind resistance provided by the requirements when judged against standard requirements for wind design; and 2) reduction of the 0.39 wind pressure rating adjustment factor to 0.30 based on an assumption that the vinyl siding used to secure exterior foam plastic sheathing to wall studs should resist the same loads as required for design of the foam plastic sheathing to resist wind loads (i.e. 90% of the wind loads versus 70% of the wind loads associated with the 0.39 factor). Two options for use of vinyl to secure foam plastic sheathing to studs are unchanged by this proposal: the 0.27 factor in R703.11.2.2 for cases where vinyl siding secures foam plastic sheathing to studs and interior gypsum is not present; and R703.11.2.3 which relies on availability and approval of vinyl siding manufacturer's instructions specifically for use over foam plastic sheathing for wind resistance.

Proposed revisions are summarized in Table 1. Additional details on revised wind pressure rating adjustment factors, wind load requirements for other structural sheathing products, and elimination of the 90 mph and less wind speed provisions are provided below.

Table 1.Summary of proposed change

Current Section Number	Proposed Section Number	Vinyl Siding Installed over:	2012 IRC Factors			Proposed Factors			Summary
			PEF	**SF**	**WPR**	**PEF**	**SF**	**WPR**	
R703.11.2 Exception	R703.11.2.1	Foam sheathing backed by materials designed to resist 100% of wind loads	0.36	1.5	1.00	0.36	1.5	1.00	*(No Change)*
R703.11.2.1	---	Foam sheathing with Interior GWB (90 mph, Exposure B)	0.36	1.5	1.00	-	-	-	*(Deleted)*
R703.11.2.2(1)	R703.11.2.2	Foam sheathing without interior GWB	1.00	2.0	0.27	1.00	2.0	0.27	*(No Change)*
R703.11.2.2(2)	R703.11.2.2 Exception	Foam sheathing with interior GWB (limited to design pressure not exceeding 30 psf)	0.70	2.0	0.39	0.90	2.0	0.30	*(Revised)*
R703.11.2.3	R703.11.2.3	Manufacturer specification for installation over foam sheathing approved to resist 100% of wind loads	*Proprietary Systems*						*(No Change)*
PEF - Pressure Equalization Factor SF - Safety Factor WPR - Wind Pressure Rating adjustment factor WPR = 0.36*1.5/PEF/SF									

Basis of vinyl siding wind rating adjustment factors

Vinyl siding wind pressure ratings are established using provisions in ASTM D 3679 Annex 1 and assume that the vinyl siding is installed over a backing material capable of resisting 100% of the wind suction loads (i.e. PEF=1.0). In those provisions, the test pressure of 15.73 psf is established as a minimum requirement based on an assumption that the vinyl siding resists only 36% of the wind suction loads (i.e. PEF=0.36) and a safety factor of 1.5. These assumptions, referred to herein as the reference case assumptions for vinyl siding wind pressure rating, are shown in Equation 1. Equation 1 can be found in ASTM D 3679 and relates test pressure, P_t, to design pressure, D_p:

$$P_t = D_p \times 0.36 \times 1.5 \qquad \text{Eq. 1}$$

For a design suction pressure, D_p, of 29.12 lb/ft^2 associated with 110 mph wind speed, Exposure B and 30 ft mean roof height, the required test pressure, P_t, is 15.73 lb/ft^2.

In 2006, changes were brought forward to address how to use these ASTM D 3679 design wind pressure ratings when vinyl siding is installed over a backing material that can't independently resist 100% of the wind loads, such as when used over many of the foam plastic sheathing products which rely on vinyl siding and its fastening to studs to secure the foam plastic sheathing to the wall studs. At that time, a wind pressure rating adjustment factor of 0.39 was approved for applications where vinyl siding was used to secure foam plastic sheathing to wall studs based on the assumption that it was securing the foam plastic sheathing for 70% of the wind suction loads (i.e. PEF = 0.70) acting on the exterior foam plastic sheathing while the remaining 30% was assumed to be resisted by interior gypsum wallboard. In addition to accounting for increased wind loads resisted by the vinyl siding (from 36% to 70%), the 0.39 factor also accounted for an increase in safety factor from 1.5 to 2.0 in recognition of the increased importance of vinyl siding when used to structurally secure foam plastic sheathing to wall studs.

Rationale for use 0.30 adjustment factor in lieu of the 0.39 factor in R703.11.2.

Since the original code change that introduced wind pressure rating adjustment factors, progress has been made to standardize the wind resistance of foam plastic sheathing with the development of ANSI/SBCA FS 100-12 *Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies*. Notably, for applications where gypsum wallboard or equivalent material is provided as an interior finish, design of the foam plastic sheathing layer for 90% of the wind suction loads (i.e. PEF=0.90) is permitted per SBCA FS 100-12 Section 6.4 as follows:

"6.4 Pressure Equalization Factor (PEF). A PEF of 1.0 shall be required for *exterior wall sheathing* applications.

Exceptions:

1. For conditions where the design negative wind pressure load determined in accordance with Section 4.0 does not exceed 30 psf, a PEF of 0.9 shall be permitted to determine negative wind pressure resistance only for *exterior wall sheathing* on wall assemblies having an interior finish of at least 0.5-inch-thick gypsum wall board (ASTM C1396) or any material of at least equivalent bending strength, rigidity and air permeability."

Design using a PEF value of 0.9, or 90% of the wind suction loads, represents an approximate 29 percent increase in loads in the foam plastic sheathing layer relative to the 70% wind load assumption used in derivation of the 0.39 factor. Consistent with the original derivation, the vinyl siding used to secure the foam plastic sheathing to the wall studs must also be designed to resist the load for which the sheathing is designed. As a result, the 0.39 factor is reduced to 0.30 in recognition of the increase from 70% to 90% of wind loads on the foam plastic sheathing layer and resisted by the vinyl siding: 0.39 x (0.7/0.9) = 0.30. Additional information on the derivation of the 0.30 factor, consistent with assumptions in derivation of existing factors in the IRC, is provided below as additional background.

For the reference case where vinyl siding wind pressure resistance is based on installation over structural sheathing capable of resisting 100% of the wind loads, test pressure, P_t, and design pressure, D_p, are related as previously shown in Equation 1 and repeated in Equation 2 for ease of reference. In this case, vinyl siding is assumed to resist 36% of the wind loads and a safety factor of 1.5 is applicable.

$P_t = D_p(\text{reference}) \times 0.36 \times 1.5$ Eq. 2

For the structural case where vinyl siding is used to secure foam plastic sheathing to wall studs for resistance to wind suction loads, test pressure, P_t, and design pressure, D_p, are related as shown in Equation 3. In this case, vinyl siding is assumed to resist 90% of the wind loads (the same loads as used for design of the foam plastic sheathing) and a safety factor of 2 is applicable.

$P_t = D_p(\text{structural}) \times 0.90 \times 2.0$ Eq. 3

Equating P_t from Equation 2 and 3 and solving for D_p(structural) results in a factor of 0.30 as follows:

$D_p(\text{structural}) = 0.30\ D_p(\text{reference})$ Eq. 4

The PEF of 0.9 recognizes that gypsum wallboard on the interior face of the wall has been shown to resist a portion of the full wind load. It is important to note; however, that the amount resisted by the gypsum wallboard continues to be studied since the contribution is a function of the relative air permeability of the exterior wall sheathing and the interior gypsum wallboard and the relative strength and stiffness of the exterior wall sheathing and the interior gypsum wallboard to name a few variables, many of which are difficult to quantify and control at time of fabrication and over time. These are among some of the reasons why the PEF of 0.7 previously assumed for development of the 0.39 factor was increased to a PEF of 0.9 resulting in a 0.30 factor. Given the sensitivity of pressure equalization to level of pressure, relative porosity of the inside wall layer to the outside wall layer, pressures used in PEF testing, and in recognition of use of gypsum wallboard in much of the underlying PEF testing, the 0.30 adjustment is only applicable when the design wind suction load does not exceed 30 psf.

The adjustment factor of 0.27 in R703.11.2.2 remains unchanged by this proposal

Where vinyl siding is used to hold the foam plastic sheathing onto the wall studs and gypsum wallboard or equivalent interior finish is not present, the default condition in SBCA FS 100-12 applies and PEF of 1.0 is used (i.e. 100% of wind load resisted by exterior foam plastic sheathing). In this case, the vinyl siding used to secure the foam plastic sheathing to the wall studs must also be designed to resist 100% of the load, equal to the load for which the sheathing is designed. The resulting wind pressure rating factor is 0.27 and remains unchanged in the proposed revisions.

Basis for removal of the 90 mph and less wind speed provisions of current R703.11.2.1

The current provisions of R703.11.2.1 have been proposed for deletion. These provisions exempt the user from checking the wind resistance of the vinyl siding if the building is located in an area where the wind speed is 90 mph or less, Wind Exposure B, and the interior finish is gypsum wallboard. These provisions result in significantly lower wind resistance than required by section R703.1.2. For example, the wind loads associated with 90 mph Exposure B is a maximum suction (negative) pressure of 19.5 psf for a 30' mean roof height (see Table 2). The minimum required test pressure for vinyl siding in accordance with ASTM D 3679 is only 15.73 psf. In this example, the minimum required test pressure is only 80% of the design pressure. It is important to note that the minimum test pressure should substantially exceed the design pressure to provide a margin of safety.

Table 2. Design wind pressure for wall claddings and cladding attachments (psf)

Wind exposure category	Mean roof height (ft)	BASIC WIND SPEED, V_{ASD} (mph-3-second gust)							
		85		90		100		110	
		max +	max -	max +	max -	max +	max -	max +	max -
B	0-15	13.0	-17.4	14.6	**-19.5**	18.0	-24.1	21.8	-29.1
	20	13.0	-17.4	14.6	**-19.5**	18.0	-24.1	21.8	-29.1
	25	13.0	-17.4	14.6	**-19.5**	18.0	-24.1	21.8	-29.1
	30	13.0	-17.4	14.6	**-19.5**	18.0	-24.1	21.8	**-29.1**
	35	13.6	-18.2	15.2	**-20.4**	18.8	-25.2	22.7	-30.5
C	0-15	15.7	-21.1	17.7	-23.6	21.8	-29.2	26.4	-35.3
	20	16.7	-22.4	18.8	-25.1	23.2	-31.0	28.0	-37.5
	25	17.5	-23.5	19.7	-26.3	24.3	-32.5	29.4	-39.3
	30	18.2	-24.4	20.4	-27.4	25.2	-33.8	30.5	-40.9
	35	18.8	-25.2	21.1	-28.3	26.1	-34.9	31.5	-42.2

Note: Design wind pressures calculated by combining wall cladding loads (for effective wind area of 10 ft^2) in Table R301.2(2) and height and exposure coefficients in Table R301.2(3). Negative (-) wind pressures represent wind suction pressures.

The extent of under-design of the vinyl siding is exacerbated when considering that 15.73 psf represents an average of 3-4 test results and does not reflect minimum values. Application of the wind pressure resistance rating described above demonstrates the extent of under-design. For the case where interior gypsum finish is present, the adjusted wind pressure resistance for the minimum vinyl siding per ASTM D 3679 becomes 0.30 x 29.1 = 8.7 psf. The value of 8.7 psf is less than half of the 19.5 psf value required for 90 mph wind speeds, Exposure B at a 30'mean roof height.

In summary, this proposal deletes the current R703.11.2.1 provisions that exempt the user from checking the wind resistance of the vinyl siding in a 90 mph Exposure B area. Both the revised section R703.11.2.2 and existing section R703.11.2.3 still remain and allow the proper installation of vinyl siding installed over foam sheathing in accordance with the vinyl siding manufacturer's installation instructions.

Cost Impact: The code change proposal will increase the cost of construction.

RB384-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.11.2-RB-PITTS.doc

RB385 – 13
Table R703.4, R703.11.2

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Insulated Vinyl Siding[aa]	035 (vinyl siding layer only)	Lap	Yes	0.120 nail (shank) with a 0.313 head or 16 gauge crown[y,z]	0.120 nail (shank) with a 0.313 head or 16 gauge crown[y]	0.120 nail (shank) with a 0.313 head or 16 gauge crown[y]	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not Allowed	16 inches on center or specified by manufacturer instructions, test report or other sections of this code.

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
Q . See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^{1}/_{2}$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.

x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners.
<u>aa. Insulated vinyl siding shall comply with ASTM D 7793.</u>

R703.11.2 Foam plastic sheathing. Vinyl siding <u>and insulated vinyl siding</u> used with foam plastic sheathing shall be installed in accordance with Section R703.11.2.1, R703.11.2.2, or R703.11.2.3.

Reason: There is general consensus among manufacturers on the installation practices for insulated vinyl siding, including several requirements the can be integrated into the installation requirements in Table R703.4. Installation specifications are very similar to vinyl siding.

These include:

- Minimum thickness requirement from ASTM D7793
- That the siding must be installed over a water-resistive Barrier
- Size of nail and/or staple and penetration depth into the stud
- Provision for how it should be installed over foam sheathing
- Fastener spacing
- Installation over foam sheathing should be treated the same as vinyl siding, the principals of section R703.11.2 will apply

Additional footnotes "aa", "y" and "z" refer to the ASTM standard for insulated vinyl siding, ASTM D7793, and fastening prescriptions similar to vinyl siding involving penetration into the stud 0.75 inches and an allowance for variation to this requirement when approved by the manufacturer.

An additional reference was added to the use of vinyl siding with foam plastic sheathing to include insulated vinyl siding. The application of insulated vinyl siding with foam sheathing is the same as vinyl siding, therefore the provision can simply apply.

For more information, go to www.insulatedsiding.info.

Cost Impact: The code change proposal will not increase the cost of construction.

RB385-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.4T-RB-DOBSON.doc

RB386 – 13
R202 (NEW), R703.13 (NEW), R703.13.1 (NEW), Chapter 44

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

Add new text as follows:

703.13 Insulated vinyl siding. Insulated vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D7793 by an approved quality control agency.

703.13.1 Insulated vinyl siding and accessories. Insulated vinyl siding and accessories shall be installed in accordance with manufacturer's installation instructions.

Add new definition as follows:

INSULATED VINYL SIDING. A vinyl cladding product with manufacturer-installed foam plastic insulating material as an integral part of the cladding product, having a minimum thermal resistance of R-2.

Add new standard to Chapter 44 as follows:

ASTM

D 7793 – 12 Standard Specification for Insulated Vinyl Siding

Reason: This definition is based on the current ASTM standard for insulated vinyl siding, ASTM D7793. Insulated vinyl siding has been available for over ten years and is now certified to an ASTM standard by an approved quality control agency. Therefore, it makes sense to introduce the standard and third party certification into the code as insulated vinyl siding grows and is embraced as a form of a cladding and home insulation. Performance requirements are specified by ASTM, ensuring that insulated vinyl siding can meet the necessary demands as a cladding and home insulation.

This change also provides a method for building officials to verify that insulated vinyl siding is code compliant, since there are separate standards for vinyl siding and insulated vinyl siding.

- Insulated vinyl siding is vinyl siding with rigid foam insulation laminated or permanently attached to the panel.
- In energy codes and energy efficiency programs, insulated siding is recognized as a form of "continuous insulation," or insulation installed on the exterior of the building that helps reduce energy loss through framing or other building material.
- Insulated siding products that bear the Certified Insulated Siding Label and are found on VSI's *Official List of Certified Products and Colors* have been independently certified by a third-party, accredited quality control agency to meet or exceed ASTM D7793.

Certified insulated vinyl siding**:**

- Meets or exceeds the industry standard for quality and performance (ASTM D7793), as verified by an independent, accredited quality control agency through twice yearly, unannounced plant inspections, product testing and quality review.
- Has demonstrated a minimum thermal resistance, or R-value, of at least R-2.0, as verified by an independent quality control agency.
- Withstands the impacts of recommended installation procedures.
- Lies straight on a flat wall and does not buckle under normal conditions.
- Weathers the effects of sunshine, rain and heavy winds of at least 110 mph.
- Meets manufacturer's advertised specifications for length, width, thickness and gloss.
- Can be identified by a variety of program logos and/or labels.
- Meets or exceeds the industry standard for performance (ASTM D7793), as verified by an independent, accredited quality control agency through twice yearly, unannounced plant inspections, product testing and quality review.

Fire Performance

Due to vinyl's chlorine base, the siding portion of insulated siding does not readily ignite and burn and resists flame spread. Vinyl siding routinely demonstrates a Class A flame spread rating (that is, a flame spread index of 25 or less when tested under ASTM E84). Rigid vinyl will not sustain combustion without an external source of heat and will tend to self-extinguish if that heat is removed. Foam plastics used in the insulation portion contain a flame retardant designed to limit rapid flame spread. Foam plastic insulation products are tested and classified for flame spread and smoke-development under ASTM E84/UL 723 by Underwriters Laboratories and other certified agencies.

Moisture Performance

Insulated siding provides a supplemental rain screen that reduces the amount of water that reaches the underlying water-resistive barrier. With a properly applied water-resistive barrier, insulated siding minimizes moisture penetration from the exterior into the wall assembly and provides a way for moisture to readily drain and dry. The presence of a layer of thermal insulation filling the space between the insulated siding and the wall sheathing also aids in the moisture management system.

For more information, go to www.insulatedsiding.info.

Cost Impact: The code change proposal will increase the cost of construction. This change will have minimal cost impact as there are products on the market certified.

Analysis: A review of the standard proposed for inclusion in the code, ASTM D 7793 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB386-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.13 (NEW) #2-RB-DOBSON.doc

RB387 – 13

R202 (NEW), Table R703.4, R703.13 (NEW), R703.13.1 (NEW), R703.13.1.1 (NEW), R703.13.1.2 (NEW), R703.13.2 (NEW), R703.13.2.1 (NEW), Chapter 44

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Polypropylene Siding[aa]	Not applicable.	Lap	Yes	Section 703.13.1	Not Allowed	As specified by the manufacturer instructions, test report or other sections of this code.	Polypropylene Siding[aa]	Not applicable.	Lap

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^{1}/_{2}$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.

w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.
x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.
aa. Polypropylene siding shall comply with ASTM D7254.

703.13 Polypropylene siding. Polypropylene siding shall be certified and labeled as conforming to the requirements of ASTM D7254 by an approved quality control agency.

703.13.1 Polypropylene siding and accessories shall be installed in accordance with manufacturer's installation instructions.

703.13.1.1 Polypropylene siding shall be installed over and attached to sheathing or other substrate, composed of wood or wood-based material with minimum thickness of 7/16 -inch, or other materials and fasteners having equivalent withdrawal resistance.

703.13.1.2 Fastener requirements. Unless otherwise specified in the approved manufacturer's instructions, nails shall be corrosion resistant, with a minimum 0.120 shank and minimum 0.313 head diameter and fully penetrate sheathing or penetrate the substrate a minimum 3/4 inch. The end of the fastener shall extend a minimum of ¼ inch beyond the opposite face of the sheathing or nailable sheathing. Staples are not permitted.

703.13.2 Polypropylene siding shall comply with section 703.13.2.1

703.13.2.1 Polypropylene siding shall not be installed on walls with a fire separation distance of less than 5 feet (1524 mm) and walls not closer than 10 feet to a building on another lot.

Exception: Walls perpendicular to the line used to determine the *fire separation distance*.

Add new definition as follow:

POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad *exterior walls* or buildings.

Add new standard to Chapter 44 as follows:

ASTM

D 7254 Standard Specification for Polypropylene (PP) Siding

Reason: This change mirrors requirements for polypropylene siding in the 2012/2015 International Building Code (IBC), by adding them to the International Residential Code.
This provision sets minimum performance requirements for polypropylene siding and requires a third party quality control agency to verify compliance to an internationally accepted ASTM standard. Additionally, confusion in the marketplace and by building officials on use of polypropylene siding vs. vinyl siding is removed, as appropriate installation and use of polypropylene siding are detailed. The proposed definition conforms to the definition in the IBC and ASTM D7254 standard. Use of polypropylene siding is also limited on walls that face each other in high density settings, similar to the intent of the requirement in the IBC.
Not all polypropylene siding products on the market today are third party certified to internationally accepted standards which set minimum performance; our industry believes there should be minimum performance requirements for compliance with the building code.

 

The *VSI Product Certification Program* added certification of polypropylene siding in 2010. Additionally, several manufacturers have code compliant evaluation reports for their products. The *VSI Product Certification Program* allows manufacturers to certify, with independent third-party verification by an approved quality control agency, that certain polypropylene siding meets or exceeds the ASTM D7254 Standard Specification for Polypropylene (PP) Siding. The program is not exclusive to VSI members and any manufacturer can participate. It has been in place since 1998 when vinyl siding certification began.

Polypropylene siding certified through the program is verified by a third-party, approved quality control agency to meet or exceed the ASTM D7254 Standard Specification for Polypropylene (PP) Siding. Certified polypropylene siding is tested to:

- Weather the elements over time without cracking, chipping, flaking, pitting, or peeling.
- Meet impact resistance requirements.
- Withstand wind pressures equivalent to 110 mph or more.
- Demonstrate flame spread performance equivalent to or better than wood materials commonly used in building construction.

Although polypropylene siding panels are specific to each manufacturer, there is general consensus among manufacturers on several installation requirements. These include:

- Use of a water-resistive barrier
- Substrate installed with polypropylene siding panels, typically OSB or plywood, must have a minimum fastener withdrawal resistance because fastener spacing varies from 5 inches to 12 inches. The fasteners must have a substrate to penetrate because they will not penetrate studs in most cases because of the typical 16 inch on center spacing.
- No attachment directly over studs
- Fastener size and length are specified; staples are not allowed
- Manufacturer specified fastener spacing

Specifications for installation, including underlayment and fasteners, are necessary for polypropylene siding, so building officials and specifiers recognize the differences between installation of vinyl siding and polypropylene siding.

For more information on polypropylene siding, go to http://www.polypropylenesiding.org/.

Cost Impact: This change will have minimal cost impact as many products on the market are already certified.

Analysis: A review of the standard proposed for inclusion in the code, ASTM D 7254 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB387-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R703.13 (NEW) #1-RB-DOBSON.doc

RB388 – 13

R202 (NEW), Table R703.4, R703.13 (NEW), R703.13.1 (NEW), R703.13.2 (NEW), R703.13.2.1 (NEW), R703.13.2.2 (NEW), R703.13.3 (NEW), R703.13.4 (NEW), Chapter 44

Proponent: Marcelo M. Hirschler, GBH International (gbhint@aol.com)

Revise as follows:

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Polypropy-lene siding [aa]	Not applicable	Lap	Yes	See Section 703.13.3 and Section 703.13.4	Not allowed	As specified by the manufacturer instructions or test report	Polypropy-lene siding [aa]	Not applicable	Lap

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^7/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^1/_2$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^1/_2$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^1/_2$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.

v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.
x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.
aa. Polypropylene siding shall comply with ASTM D7254 and Section R703.13.

R703.13 Polypropylene siding. Polypropylene siding shall be certified and *labeled* as conforming to the requirements of ASTM D7254 by an *approved* quality control agency.

R703.13.1 Polypropylene siding and accessories shall be installed in accordance with the manufacturer's installation instructions.

R703.13.2 Flame Spread Index. Polypropylene siding shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 and shall comply either with the requirements of Section R703.13.2.1 or with those of section R703.13.2.2.

R703.13.2.1 Polypropylene siding shall not be installed on walls with a fire separation distance of less than 5 feet (1524 mm) and walls not closer than 10 feet to a building on another lot.

Exception: Walls perpendicular to the line used to determine the *fire separation distance*.

R703.13.2.2 The certification of the flame spread index shall be accompanied by a test report stating that all portions of the test specimen ahead of the flame front remained in position during the test in accordance with ASTM E84 or UL 723.

R703.13.3 Polypropylene siding shall be installed over and attached to sheathing or other substrate, composed of wood or wood-based material with minimum thickness of 7/16 -inch, or other materials and fasteners having equivalent withdrawal resistance.

R703.13.4 Fastener requirements. Unless otherwise specified in the approved manufacturer's instructions, nails shall be corrosion resistant, with a minimum 0.120 shank and minimum 0.313 head diameter, minimum length of 1.50 inches and penetrate sheathing or substrate a minimum 7/16 inch. Staples shall not be used for fastening polypropylene siding.

Add new definition as follows:

POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad *exterior walls* of buildings.

Add new standard to Chapter 44 as follows:

ASTM

D 7254 - 07 Standard Specification for polypropylene (PP) siding

Reason: This proposal recommends incorporating into the IRC language permitting the use of polypropylene siding in a manner fully consistent with the language contained in the IBC, except that it allows also an exception for walls perpendicular to the line for the fire separation distance. This ensures the use of the product with adequate fire safety. Further details are shown in the subsequent paragraphs.

Polypropylene (PP) siding is being used in residential construction based on AC366 and is also used in other construction in accordance with the requirements in the building code, as shown below. These requirements are not consistent primarily because the fire safety requirements in the IBC do not permit the siding test specimen to fall on the floor during the ASTM E84 fire test unless there is a 10 foot separation between buildings while those in AC 366 are silent and rely on ASTM D7254 which does not have this safety. This proposal incorporates the same separation (with the same concept of the permission if the materials stays in place during the test) but it also offers an exception for walls perpendicular to the line used to determine the fire separation distance.

The flame spread index in accordance with ASTM E84 must be assessed with a test specimen that remains in position during the test ahead of the flame front because of the well-known tendency for polypropylene to melt and drip. This tendency of polypropylene to melt and drip has been recognized by the IBC when it incorporated the requirements in section 1404.12.1 (for polypropylene siding) and in section 803.12 (for polypropylene used as interior finish). In the case of polypropylene siding the IBC has language consistent with the proposed to the IRC for the siding. In the case of polypropylene as interior finish, the IBC does not allow it to be tested to ASTM E84 but requires the use of the room-corner test (NFPA 286). The proposal does not recommend using the room-corner test for siding in the IRC: that is unnecessary. With the proposed provisions, enough safety is provided that polypropylene siding can be incorporated into the IRC.

It is easy for the consumer to confuse PP siding with vinyl siding, especially since most retailers carry them together. However, PP siding is very different in fire performance than either vinyl siding or wood (cedar) siding. The table below shows recent fire tests on two different PP siding materials and on a wood (cedar) siding using the cone calorimeter, ASTM E1354, at an incident heat flux of 25 kW/m^2, as well as some material tests on vinyl (PVC) and on a fire retarded polypropylene.

Cone Calorimeter (ASTM E1354) Tests at 25 kW/m^2 incident heat flux		
	Peak Heat Release Rate (in kW/m^2)	**Effective Heat of Combustion (in MJ/kg)**
Siding Tests		
Cedar siding	309	13
PP siding	546	25
PP siding 2	878	32
Material Tests		
Vinyl (PVC)	190	9
FR Polypropylene	200	25

The table below shows that polypropylene can be made so that it meets the requirements indicated above, in the ASTM E84 test without melting, and perform just like PVC (vinyl) or wood products.

ASTM E84 (Steiner tunnel) tests on some exemplar materials		
Material	**Flame Spread Index**	**Flaming on Floor Ahead of Flame Front**
PVC (vinyl)	10	None
FR Polypropylene	50	None
Western red cedar	70	None
Douglas fir	70-100	None
Western white pine	75	None

The revisions for Table R703.4 are consistent with actual usage. For example, since polypropylene siding is significantly heavier (and often thicker) than vinyl siding, no manufacturers have approved the use of staples for fastening and some manufacturers even prohibit the use of staples in their instructions. Polypropylene siding requires more frequent fasteners than vinyl siding.

The relevant sections of the IBC, AC366 and ASTM D7254 are shown here.

AC366
3.0 TEST METHODS AND PERFORMANCE REQUIREMENTS
3.1 General: *Polypropylene siding shall conform to the requirements of ASTM D7254.*
3.2 Wind Load Resistance: *Wind load resistance testing shall be conducted in accordance with ASTM D7254 and ASTM D5206. The test assembly shall be constructed in a manner consistent with the construction methods and materials that are to be recognized in the evaluation report.*
Allowable wind pressures shall be determined in accordance with Annex A1 of ASTM D7254. Design wind pressures shall be determined in accordance with Chapter 16 of the IBC, and shall not exceed the allowable negative wind loads.
Positive wind loading is not considered, since the siding shall be applied over solid sheathing capable of resisting design wind pressures. In areas enforcing the IBC, where construction is located in areas where the basic wind speed (3-second gust) does not exceed 100 miles per hour (161 km/h) and the building heights do not exceed 40 feet (12 192 mm), solid sheathing as noted in Section 1405.14.1 of the 2009 IBC and Section 1405.13.1 of the 2006 IBC, is acceptable. Where construction is located in areas where the basic wind speed (3-second gust) exceeds 100 miles per hour (161 km/h) or the building heights are in excess of 40 feet (12 192 mm), negative wind load resistance tests shall be conducted in accordance with ASTM D5206 and with Section 5.4 of ASTM D7254. The test assembly shall be constructed in a manner consistent with the construction methods and materials that are to be recognized in the evaluation report. Allowable wind pressures shall be determined in accordance with Annex A1 of ASTM D7254.
In areas enforcing the IRC, where construction is located in areas where the basic wind speed does not exceed 110 miles per hour (177 km/h), solid sheathing as noted in Table R703.4 of the IRC, is acceptable. For basic wind speeds equal to or greater than 110 mph (177 km/h), design shall be in accordance with Section R301.2.1.1 of the IRC, and wind load resistance tests shall be conducted in accordance with ASTM D5206. The test assembly shall be constructed in a manner consistent with the construction methods and materials that are to be recognized in the evaluation report. Allowable negative wind pressures shall be determined in accordance with Annex A1 of ASTM D7254.
3.3 Ignition Resistance:
3.3.1 Test Method: *For recognition under the IBC, for construction other than Type VB, the siding shall be tested in accordance with NFPA 268 and IBC Section 1406.2. Ignition resistance testing is not required under the IRC.*
3.3.2 Conditions of Acceptance: *The minimum allowable fire separation distance for siding installed on the exterior of buildings of other than Type VB construction shall be as set forth in IBC Table 1406.2.1.2, based on the results of testing.*

ASTM D7254:
6.4 Windload Resistance—Conduct the test on windload resistance of the finished siding in accordance with Test Method D5206.
6.5 Surface Flame Spread—Conduct the test on surface flame spread characteristics in accordance with Test Method E84. The test specimen shall either be self-supporting by its own structural characteristics or held in place by added supports along the test specimen surface.

IBC 202 includes:
POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad *exterior walls* of buildings.
IBC 1404.12 Polypropylene siding. Polypropylene siding shall be certified and labeled as conforming to the requirements of ASTM D7254 and those of Section 1404.12.1 or 1404.12.2 by an approved quality control agency. Polypropylene siding shall be installed in accordance with the requirements of Section 1405.18 and in accordance with the manufacturer's installation instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.
IBC 1404.12.1 Flame spread index. The certification of the flame spread index shall be accompanied by a test report stating that all portions of the test specimen ahead of the flame front remained in position during the test in accordance with ASTM E84 or UL 723.
IBC 1404.12.2 Fire separation distance. The fire separation distance between a building with polypropylene siding and the adjacent building shall be no less than 10 feet (3048 mm).
IBC 1405.18 Polypropylene siding. Polypropylene siding conforming to the requirements of this section and complying with Section 1404.12 shall be limited to exterior walls of Type VB construction located in areas where the wind speed specified in Chapter 16 does not exceed 100 miles per hour (45 m/s) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (45 m/s), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with Chapter 16 shall be submitted. Polypropylene siding shall be installed in accordance with the manufacturer's installation instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.
IBC 803.12 High-density Polyethylene (HDPE) and Polypropylene (PP). Where high-density polyethylene or polypropylene is used as an interior finish it shall comply with Section 803.1.2.
IBC 803.1.2 Room corner test for interior wall or ceiling finish materials. *Interior wall or ceiling finish* materials shall be permitted to be tested in accordance with NFPA 286. Interior wall or ceiling finish materials tested in accordance with NFPA 286 shall comply with Section 803.1.2.1.
IBC 803.1.2.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:
1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m^2.

Cost Impact: The code change proposal will minimally increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM D 7254 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB388-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB389 – 13

R703.4, Table R703.4, R703.13 (NEW), R703.13.1 (NEW), Table R703.13.1 (NEW), R703.13.2 (NEW), Table R703.13.2 (NEW),

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee and American Chemistry Council (jcrandell@aresconsulting.biz)

Revise as follows:

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other *approved* aluminum, stainless steel, zinc-coated or other *approved* corrosion-resistive fasteners. Where the basic wind speed in accordance with Figure R301.2(4)A is 110 miles per hour (49 m/s) or higher, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). <u>Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.</u>

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[aa]	Direct to studs	Number or spacing of fasteners

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^{1}/_{2}$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.

v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.

w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.

x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.

y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.

z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.

aa. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.

R703.13 Cladding attachment over foam sheathing to wood framing. Cladding shall be specified and installed in accordance with Section R703, the cladding manufacturer's approved installation instructions, including any limitations for use over foam plastic sheathing, or an approved design. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section R703.13.1, Section R703.13.2, or an approved design for support of cladding weight.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing; refer to Section R703.7.

R703.13.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table R703.13.1.

TABLE R703.13.1
CLADDING MINIMUM FASTENING REQUIREMENTS
FOR DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING
TO SUPPORT CLADDING WEIGHT[a]

Cladding Fastener Through Foam Sheathing into:	Cladding Fastener Type and Minimum Size[b]	Cladding Fastener Vertical Spacing (inches)	Maximum Thickness of Foam Sheathing[c] (inches)					
			16" o.c. Fastener Horizontal Spacing			24" o.c. Fastener Horizontal Spacing		
			Cladding Weight:			Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Wood Framing (minimum 1-1/4 inch penetration)	0.113" diameter nail	6	2	1	DR	2	0.75	DR
		8	2	1	DR	2	0.5	DR
		12	2	0.5	DR	2	DR	DR
	0.120" diameter nail	6	3	1.5	0.5	3	0.75	DR
		8	3	1	DR	3	0.5	DR
		12	3	0.5	DR	2	DR	DR
	0.131" diameter nail	6	4	2	0.75	4	1	DR
		8	4	1.5	0.5	4	0.75	DR
		12	4	0.75	DR	2	0.5	DR
	0.162" diameter nail	6	4	4	1.5	4	2	1
		8	4	3	1	4	1.5	0.75
		12	4	2	0.75	4	1	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa

DR = design required

o.c. = on center

a. Wood framing shall be Spruce-Pine-Fir or any wood species with a specific gravity of 0.42 or greater in accordance with AFPA/NDS.

b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.

c. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.

R703.13.2 Furred cladding attachment. Where wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table R703.13.2. Where placed horizontally, wood furring shall be preservative treated wood in accordance with Section R317.1 or naturally durable wood and fasteners shall be corrosion resistant in accordance Section R317.3.

TABLE R703.13.2 FURRING MINIMUM FASTENING REQUIREMENTS FOR APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT[a,b]

Furring Material	Framing Member	Fastener Type and Minimum Size	Minimum Penetration into Wall Framing (inches)	Fastener Spacing in Furring (inches)	Maximum Thickness of Foam Sheathing[d] (inches)						Allowable Design Wind Pressure for Furring (psf)	
					16”oc Furring[e]			24”oc Furring[e]				
					Siding Weight:			Siding Weight:				
					3 psf	11 psf	25 psf	3 psf	11 psf	25 psf	16”oc Furring	24”oc Furring
Minimum 1x Wood Furring[c]	Minimum 2x Wood Stud	0.131” diameter nail	1-1/4	8	4	2	1	4	1.5	DR	46.5	31.0
				12	4	1.5	DR	3	1	DR	31.0	20.7
				16	4	1	DR	3	0.5	DR	23.3	15.5
		0.162” diameter nail	1-1/4	8	4	4	1.5	4	2	0.75	57.5	38.3
				12	4	2	0.75	4	1.5	DR	38.3	25.6
				16	4	1.5	DR	4	1	DR	28.8	19.2
		#10 wood screw	1	12	4	2	0.75	4	1.5	DR	107.3	71.6
				16	4	1.5	DR	4	1	DR	79.0	52.7
				24	4	1	DR	3	DR	DR	35.1	23.4
		¼” lag screw	1-1/2	12	4	3	1	4	2	0.5	140.4	93.6
				16	4	1.5	DR	4	1.5	DR	79.0	52.7
				24	4	1.5	DR	4	0.75	DR	35.1	23.4

For SI: 1” = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa.
DR = design required
o.c. = on center

a. Wood framing and furring shall be Spruce-Pine-Fir or any wood species with a specific gravity of 0.42 or greater in accordance with AFPA/NDS.
b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
c. Where the required cladding fastener penetration into wood material exceeds ¾ inch (19.1 mm) and is not more than 1-1/2 inches (38.1 mm), a minimum 2x wood furring shall be used or an approved design.
d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.
e. Furring shall be spaced a maximum of 24 inches (610 mm) on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8 inch (203.2 mm) and 12 inch (304.8 mm) fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches (406.4 mm) and 24 inches (610 mm) on center, respectively.

Reason: The proposed cladding connection requirements were proposed for the IBC 2015 (FS 195-11/12) but were withdrawn at the final action hearing to address more recent research to improve connection performance. An earlier version of these siding connection requirements already exist in the New York State Energy Code which is based on the 2009 IECC. Similar requirements for the IECC 2012 were denied last year mainly because it was felt that they belonged in the building code, not the energy code. These requirements fill an information gap in the IRC provisions for exterior wall covering assemblies that include foam plastic insulation. Separate proposals address connection to other wall framing materials and were approved for the 2015 IBC.

The proposed requirements are based on a project sponsored by the New York State Energy Research and Development Agency (NYSERDA). The project report is available for download at www.nyserda.ny.gov/~/media/Files/Publications/Research/Other Technical Reports/fastening-systems-for-continuous-insulation.pdf . The report explains the technical basis for the proposed requirements which, for purposes of this proposal, have been modified to increase the reduction factor to control deflection from 1.5 to 3 (fastener strength halved) to better ensure long-term deflection control. For comparison, the reduction factor used in the NDS provisions for fastener shear resistance calculation is 2.2.

The purpose of the NYSERDA project was to develop prescriptive fastening requirements for cladding materials installed over foam sheathing to ensure adequate performance. The project included testing of cladding attachments through various thicknesses of foam sheathing using various fastener types on steel frame wall assemblies (see separate proposal for attachment to steel framing). Supplemental testing also was sponsored by the Foam Sheathing Coalition (lab report available at http://fsc.americanchemistry.com/Building-Code/Installation-of-Cladding) to address attachments to wood framing and the resulting data is included in the data set analyzed and presented in the NYSERDA project report. The proposed cladding attachment requirements and foam sheathing thickness limits are based on rational analysis verified by the extensive test data to control cladding connection movement to no more than 0.015” slip under cladding weight or dead load. This deflection controlled approach resulted in safety factors commonly in the range of 5 to 8 relative to average shear capacity. Similar tests by other independent parties, such Wiss, Janey, & Elsner (unpublished data) and also Building Science Corporation for DOE’s Building America program (report pending) have shown similar results and have contributed to the verification of this proposal.

Finally, the proposal provides prescriptive requirements for attachment of furring to resist wind loading – something that is currently not addressed in the IRC. Furring is a common means of attaching cladding over foam sheathing and provides for improved siding durability. The allowable wind pressure limits are based on the lesser of fastener withdrawal and furring bending strength.

Three separate proposals for wood, steel, and concrete/masonry wall applications have been prepared to ensure that these different applications are considered independently. If one or more these proposals are approved, the proponent will work with ICC staff to resolve duplicative formatting/numbering of the proposed new code sections.

Cost Impact:

RB389-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB390 – 13

R703.4, Table R703.4, R703.13 (NEW), R703.13.1 (NEW), Table R703.13.1 (NEW), R703.13.2 (NEW), Table R703.13.2 (NEW)

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee and American Chemistry Council (jcrandell@aresconsulting.biz); Mark Nowak, M Nowak Consulting LLC, representing Steel Framing Alliance

Revise as follows:

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other *approved* aluminum, stainless steel, zinc-coated or other *approved* corrosion-resistive fasteners. Where the basic wind speed in accordance with Figure R301.2(4)A is 110 miles per hour (49 m/s) or higher, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[aa]	Direct to studs	Number or spacing of fasteners

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 I nches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.

s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^1/_2$ inch long galv. roofing nail through the top edge of each plank at each stud.
u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.
x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.
a.a. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.

R703.13 Cladding attachment over foam sheathing to cold-formed steel framing. Cladding shall be specified and installed in accordance with Section R703, the cladding manufacturer's approved installation instructions, including any limitations for use over foam plastic sheathing, or an approved design. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section R703.13.1, Section R703.13.2, or an approved design for support of cladding weight.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing; refer to Section R703.7.

R703.13.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table R703.13.1.

TABLE R703.13.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT[1]

Cladding Fastener Through Foam Sheathing into:	Cladding Fastener Type and Minimum Size[2]	Cladding Fastener Vertical Spacing (inches)	Maximum Thickness of Foam Sheathing[3] (inches)					
			16"oc Fastener Horizontal Spacing			24"oc Fastener Horizontal Spacing		
			Cladding Weight:			Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Steel Framing (minimum penetration of steel thickness + 3 threads)	#8 screw into 33 mil steel or thicker	6	3	3	1.5	3	2	DR
		8	3	2	0.5	3	1.5	DR
		12	3	1.5	DR	3	0.75	DR
	#10 screw into 33 mil steel	6	4	3	2	4	3	0.5
		8	4	3	1	4	2	DR
		12	4	2	DR	3	1	DR
	#10 screw into 43 mil steel or thicker	6	4	4	3	4	4	2
		8	4	4	2	4	3	1.5
		12	4	3	1.5	4	3	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa
DR = design required
o.c. = on center

1. Steel framing shall be minimum 33 ksi steel for 33 mil and 43 mil steel and 50 ksi steel for 54 mil steel or thicker.
2. Screws shall comply with the requirements of ASTM C1513.
3. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.

R703.13.2 Furred cladding attachment. Where steel or wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table R703.13.2. Where placed horizontally, wood furring shall be preservative treated wood in accordance with Section R317.1 or naturally durable wood and fasteners shall be corrosion resistant in accordance Section R317.3. Steel furring shall have a minimum G60 galvanized coating.

TABLE R703.13.2
FURRING MINIMUM FASTENING REQUIREMENTS FOR APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT[1]

Furring Material	Framing Member	Fastener Type and Minimum Size[2]	Minimum Penetration into Wall Framing (inches)	Fastener Spacing in Furring (inches)	Maximum Thickness of Foam Sheathing[4] (inches)						Allowable Design Wind Pressure for Furring (psf)	
					16"oc FURRING[5]			24"oc FURRING[5]			16"oc Furring	24"oc Furring
					Cladding Weight:			Cladding Weight:				
					3 psf	11 psf	25 psf	3 psf	11 psf	25 psf		
Minimum 33mil Steel Furring or Minimum 1x Wood Furring[3]	33 mil Steel Stud	#8 screw	Steel thickness + 3 threads	12	3	1.5	DR	3	0.5	DR	52.9	35.3
				16	3	1	DR	2	DR	DR	39.7	26.5
				24	2	DR	DR	2	DR	DR	26.5	17.6
		#10 screw	Steel thickness + 3 threads	12	4	2	DR	4	1	DR	62.9	41.9
				16	4	1.5	DR	3	DR	DR	47.1	31.4
				24	3	DR	DR	2	DR	DR	31.4	21.0
	43 mil or thicker Steel Stud	#8 Screw	Steel thickness + 3 threads	12	3	1.5	DR	3	0.5	DR	69.0	46.0
				16	3	1	DR	2	DR	DR	51.8	34.5
				24	2	DR	DR	2	DR	DR	34.5	23.0
		#10 screw	Steel thickness + 3 threads	12	4	3	1.5	4	3	DR	81.9	54.6
				16	4	3	0.5	4	2	DR	61.5	41.0
				24	4	2	DR	4	0.5	DR	35.1	23.4

For SI: 1" = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa.
DR = design required
o.c. = on center

1. Wood furring shall be Spruce-Pine-Fir or any softwood species with a specific gravity of 0.42 or greater. Steel furring shall be minimum 33 ksi steel. Steel studs shall be minimum 33 ksi steel for 33mil and 43 mil thickness and 50 ksi steel for 54 mil steel or thicker.
2. Screws shall comply with the requirements of ASTM C1513.
3. Where the required cladding fastener penetration into wood material exceeds ¾ inch (19.1 mm) and is not more than 1-1/2 inches (38.1 mm), a minimum 2 inch (51 mm) nominal wood furring shall be used or an approved design.
4. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.
5. Furring shall be spaced a maximum of 24 inches (610 mm) on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8 inch (203.2 mm) and 12 inch (304.8 mm) fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches (406.4 mm) and 24 inches (610 mm) on center, respectively.

Reason: The proposed cladding connection requirements have been approved for the 2015 IBC (FS 194-11/12) and already exist in the New York State Energy Code which is based on the 2009 IECC. Similar requirements for the IECC 2012 were considered last code cycle, but it was clearly expressed that these provision are a better fit for the building code. These requirements fill an important need in the IRC provisions for exterior wall covering assemblies that include foam plastic insulation.

The proposed requirements are based on a project sponsored by the New York State Energy Research and Development Agency (NYSERDA) and the Steel Framing Alliance. The project report is available for download at http://data.memberclicks.com/site/sfa/NYSERDA_TASK_3_REPORT%20-%20FINAL_(3-22-10).pdf . The report explains the technical basis for the proposed requirements.

The purpose of the NYSERDA project was to develop prescriptive fastening requirements for cladding materials installed over foam sheathing to ensure adequate performance. The project included testing of cladding attachments through various thicknesses of foam sheathing using various fastener types on steel frame wall assemblies. Supplemental testing also was sponsored by the Foam Sheathing Coalition (lab report available at www.foamsheathing.org) to address attachments to wood framing and the resulting data is included in the data set analyzed and presented in the NYSERDA project report. The proposed cladding attachment requirements and foam sheathing thickness limits are based on rational analysis verified by the extensive test data to control cladding connection movement to no more than 0.015" slip under cladding weight or dead load. This deflection controlled approach resulted in safety factors commonly in the range of 5 to 8 relative to average shear capacity.

Cost Impact: The code change proposal will not increase the cost of construction.

RB390-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB391 – 13
R703.4, Table R703.4, R703.13 (NEW)

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee / American Chemistry Council (jcrandell@aresconsulting.biz)

Revise as follows:

R703.4 Attachments. Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table R703.4 or with other *approved* aluminum, stainless steel, zinc-coated or other *approved* corrosion-resistive fasteners. Where the basic wind speed in accordance with Figure R301.2(4)A is 110 miles per hour (49 m/s) or higher, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). <u>Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.</u>

TABLE R703.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICKNESS[a] (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[<u>aa</u>]	Direct to studs	Number or spacing of fasteners

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.

a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.
<u>d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.</u>
e. Aluminum nails shall be used to attach aluminum siding.
f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
g. All attachments shall be coated with a corrosion-resistant coating.
h. Shall be of approved type.
i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.
k. Hardboard siding shall comply with CPA/ANSI A135.6.
l. Vinyl siding shall comply with ASTM D 3679.
m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing a nd penetrate framing $1^{1}/_{2}$ inches.
n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.
p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
q. See Section R703.10.1.
r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.
s. See Section R703.10.2.
t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^{1}/_{2}$ inch long galv. roofing nail through the top edge of each plank at each stud.

u. See Section R703.2 exceptions.
v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.
w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.
x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.
z. Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than 0.75 inches through wood or wood structural sheathing with or without penetration into the framing.
aa. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Section R703.13.

R703.13 Cladding attachment over foam sheathing to masonry or concrete wall construction. Cladding shall be specified and installed in accordance with Section 703.4 and the cladding manufacturer's installation instructions or an approved design. Foam sheathing shall be attached to masonry or concrete construction in accordance with the insulation manufacturer's installation instructions or an approved design. Furring and furring attachments through foam sheathing into concrete or masonry substrate shall be designed to resist design loads determined in accordance with Section R301, including support of cladding weight as applicable. Fasteners used to attach cladding or furring through foam sheathing to masonry or concrete substrates shall be approved for application into masonry or concrete material and shall be installed in accordance with the fastener manufacturer's installation instructions.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing and connection to a masonry or concrete substrate, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.7.

Reason: Two other proposals submitted on the topic of attachment of cladding through foam sheathing address wood and steel framing applications based on experimental data and rational analysis addressed in the reason statements for those proposals. Similar solutions and guidance for attachment of cladding to masonry/concrete walls through foam sheathing is needed. Research is not yet available to justify prescriptive "off-the-shelf" solutions with standardized types of concrete/masonry fasteners. Also, many fasteners best suited for this application are proprietary and approved data and design is the best approach. Therefore, this proposal requires engineered design of cladding connections through foam sheathing to masonry/concrete. The exceptions recognize cases where appropriate attachment solutions may already exist. An identical provision was approved for the 2015 IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB391-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB392 – 13

R703.2, R703.3, Table R703.3 (New), R703.3.1, R703.3.2, R703.4, Table R703.4, R703.3.1, R703.3.2, R703.3.3 (NEW), R703.5.1 (NEW), R703.8, R703.12, R703.12.3 (NEW),

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D 226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). The felt or other approved material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: Omission of the water-resistive barrier is permitted in the following situations:

1. In detached accessory buildings.
~~2. Under exterior wall finish materials as permitted in Table R703.4.~~
~~3~~ 2. Under paperbacked stucco lath when the paper backing is an approved water-resistive barrier.

~~R703.4~~ R703.3 Nominal thickness and attachments. ~~Unless specified otherwise, all~~ The nominal thickness and attachment of exterior wall coverings shall be ~~securely fastened~~ in accordance with Table ~~R703.4~~ R703.3, the wall covering material requirements of this section, and the wall covering manufacturer's installation instructions ~~or with other *approved* aluminum, stainless steel, zinc-coated or other *approved* corrosion-resistive fasteners~~. Nominal material thicknesses in Table R703.3 are based on a maximum stud spacing of 16 inches on center. Where specified by the siding manufacturer's instructions and supported by a test report or other documentation, attachment to studs with greater spacing is permitted. Fasteners for exterior wall coverings shall be in accordance with Section R703.3.2

R703.3.1 Wind limitations. Where the basic wind speed in accordance with Figure R301.2(4)A is 110 miles per hour (49 m/s) or higher, the attachment of wall coverings shall be designed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R703.3.2 Fasteners. Exterior wall coverings shall be securely fastened with aluminum, galvanized, stainless steel or rust-preventative coated nails or staples in accordance with Table R703.3 or with other *approved* corrosion-resistant fasteners in accordance with the wall covering manufacturer's installation instructions. Nails and staples shall comply with ASTM F 1667. Nails shall be T-head, modified round head, or round head with smooth or deformed shanks. Staples shall have a minimum crown width of 7/16-inch outside diameter and be manufactured of minimum 16 gage wire. Where fiberboard, gypsum, or foam plastic sheathing backing is used, nails or staples shall be driven into the studs. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.

R703.3.3 Minimum fastener length and penetration. Fasteners shall have the greater of the minimum length specified in Table R703.3 or as required to provide a minimum penetration into framing as follows:

1. Fasteners for horizontal aluminum siding, steel siding, particleboard panel siding, wood structural panel siding per ANSI/APA-PRP 210, fiber-cement panel siding, and fiber-cement lap siding

installed over foam plastic sheathing shall penetrate a minimum of 1-1/2 inches into framing or shall be in accordance with the manufacturer's installation instructions.

2. Fasteners for hardboard panel and lap siding shall penetrate a minimum of 1-1/2 inches into framing.
3. Fasteners for vinyl siding installed over wood or wood structural panel sheathing shall penetrate a minimum of 1-1/4 inches into sheathing and framing combined. Where approved by the manufacturer's instructions or test report, vinyl siding shall be permitted to be installed with fasteners penetrating not less than .75 inches through wood or wood structural sheathing with or without penetration into the framing. Fasteners for vinyl siding installed over foam plastic sheathing shall be in accordance with Section R703.11.2. Fasteners for vinyl siding installed over fiberboard or gypsum sheathing or direct to studs shall penetrate a minimum of 1-1/4 inches into framing.
4. Fasteners for vertical or horizontal wood siding shall penetrate a minimum of 1-1/2 inches into studs, studs and wood sheathing combined, or blocking.
5. Fasteners for siding material installed over foam plastic sheathing shall have sufficient length to accommodate foam plastic sheathing thickness and to penetrate framing or sheathing and framing combined as specified above.

~~R703.8~~ R703.4 Flashing. *Approved* corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. The flashing shall extend to the surface of the exterior wall finish. *Approved* corrosion-resistant flashings shall be installed at all of the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall also incorporate flashing or protection at the head and sides.
   1.2. In accordance with the flashing design or method of a registered design professional.
   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

~~R703.3~~ R703.5 Wood, hardboard and wood structural panel siding. Wood, hardboard, and wood structural panel siding shall be installed in accordance with this section and Table R703.3. Hardboard siding shall comply with CPA/ANSI A135.6.

R703.5.1 Vertical wood siding. Wood siding applied vertically shall be nailed to horizontal nailing strips or blocking set no more than 24 inches on center.

~~R703.3.1~~ R703.5.2 Panel siding. 3/8" wood structural panel siding shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. 7/16" wood structural panel siding or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.

Joints in wood, hardboard or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped a minimum of 1 inch (25 mm) or shall be shiplapped or shall be flashed with Z-flashing and occur over solid blocking, wood or wood structural panel sheathing.

~~R703.3.2~~ R703.5.3 Horizontal wood siding. Horizontal lap siding shall be installed in accordance with the manufacturer's recommendations. Where there are no recommendations the siding shall be lapped a minimum of 1 inch (25 mm), or 1/2 inch (13 mm) if rabbeted, and shall have the ends caulked, covered with a batten or sealed and installed over a strip of flashing.

R703.12 Adhered masonry veneer installation. Adhered masonry veneer shall comply with the requirements of Section R703.6.3. Adhered masonry veneer shall be attached in accordance with Section R703.6.1 or the manufacturer's instructions. Adhered masonry veneer shall be installed in accordance with Sections 6.1 and 6.3 of TMS 402/ACI 530/ASCE 5 or the manufacturer's instructions.

R703.12.3 Water-resistive barrier. ~~The~~ A water-resistive barrier shall be installed~~,~~ as required by Section R703.2 and shall comply with the requirements of Section R703.6.3. The water-resistive barrier ~~Table R703.4, Footnote w,~~ shall lap over the exterior of the attachment flange of the screed or flashing provided in accordance with Section R703.12.2.

TABLE R703.3
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS (inches)	JOINT TREAT-MENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
Anchored veneer: brick, concrete, masonry or stone (See Section R703.7)		2	Per Section R703.7	Per Section R703.7					
Adhered veneer: concrete, stone or masonry (See Section R703.12)		—	Per Section R703.12	Per Section R703.12					
Fiber-cement siding	Panel siding (See Section R703.10.1)	5/16	(Per Section R703.10.1)	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	4d common (1½" x 0.099")	6" panel edges 12" inter. sup.
Fiber-cement siding	Lap siding (See Section R703.10.2)	5/16	(Per Section R703.10.2)	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113") or 11 gage roofing nail	Note f
Hardboard panel siding (See Section R703.3)		7/16	—	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	6" panel edges 12" inter. sup.[d]
Hardboard lap siding (See Section R703.3)		7/16	Note e	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	Same as stud spacing 2 per bearing
Horizontal aluminum[a]	Without insulation	0.019[b]	Lap	Siding nail 1½" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 1½" x 0.120"	Not allowed	Same as stud

SIDING MATERIAL		NOMINAL THICKNESS (inches)	JOINT TREAT-MENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS: Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	Number or spacing of fasteners
		0.024	Lap	Siding nail 1½" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 1½" x 0.120"	Not Allowed	spacing
	With insulation	0.019	Lap	Siding nail 1½" x 0.120"	Siding nail 2½" x 0.120"	Siding nail 2½" x 0.120"	Siding nail 1½" x 0.120"	Siding nail 1½" x 0.120"	
Particleboard panels		3/8	—	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	Not allowed	6" panel edges 12" inter. sup.
		1/2	—	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	
		5/8	—	6d box nail (2" x 0.099")	8d box nail (2½" x 0.113")	8d box nail (2½" x 0.113")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	
Steel[c]		29 ga.	Lap	Siding nail (1¾" x 0.113") Staple–1¾"	Siding nail (2¾" x 0.113") Staple–2½"	Siding nail (2½" x 0.113") Staple–2¼"	Siding nail (1¾" x 0.113") Staple–1¾"	Not allowed	Same as stud spacing
Vinyl siding (See Section R703.11)		0.035	Lap	0.120" nail (shank) with a 0.313" head or 16 gauge staple with 3/8 to ½-inch crown	0.120" nail (shank) with a 0.313" head or 16 gauge staple with 3/8 to ½-inch crown	0.120" nail (shank) with a 0.313" head or 16 gauge staple with 3/8 to ½-inch crown	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not allowed	16 inches on center or specified by the manufacturer instructions or test report
Wood siding (See Section R703.3)	Wood rustic, drop	3/8 Min	Lap	6d box or siding nail (2" x 0.099")	6d box or siding nail (2" x 0.099")	6d box or siding nail (2" x 0.099")	6d box or siding nail (2" x 0.099")	8d box or siding nail (2½" x 0.113") Staple–2"	Face nailing up to 6" widths, 1 nail per bearing; 8" widths and over, 2 nails per bearing
	Shiplap	19/32 Average	Lap						
	Bevel	7/16							
	Butt tip	3/16	Lap						
Wood structural panel ANSI/APA PRP-210 siding (exterior grade) (See Section R703.3)		3/8 – 1/2	Note e	2" x 0.099" siding nail	2½" x 0.113" siding nail	2½" x 0.113" siding nail	2½" x 0.113" siding nail	2" x 0.099" siding nail	6" panel edges 12" inter. sup.
Wood structural panel lapsiding (See Section R703.3)		3/8 – 1/2	Note e Note g	2" x 0.099" siding nail	2½" x 0.113" siding nail	2½" x 0.113" siding nail	2½" x 0.113" siding nail	2" x 0.099" siding nail	8" along bottom edge

For SI: 1 inch = 25.4 mm.

a. Aluminum nails shall be used to attach aluminum siding.

b. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.

c. Shall be of approved type.

d. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.

e. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.

f. Face nailing: one 6d common nail through the overlapping planks at each stud. Concealed nailing: one 11 gage 1½ inch long galv. roofing nail through the top edge of each plank at each stud in accordance with the manufacturer's installation instruction.

g. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.

~~TABLE R703.4~~
~~WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS~~

~~SIDING MATERIAL~~		~~NOMINAL THICKNESS~~[a] ~~(inches)~~	~~JOINT TREATMENT~~	~~WATER-RESISTIVE BARRIER REQUIRED~~	~~TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS~~[b, c, d]					
					~~Wood or wood structural panel sheathing into stud~~	~~Fiberboard sheathing into stud~~	~~Gypsum sheathing into stud~~	~~Foam plastic sheathing into stud~~	~~Direct to studs~~	~~Number or spacing of fasteners~~
~~Horizonal aluminum~~[e]	~~Without insulation~~	~~0.019~~[f] ~~0.024~~	~~Lap~~	~~Yes~~	~~0.120 nail 1 1/2″ long~~	~~0.120 nail 2″ long~~	~~0.120 nail 2″ long~~	~~0.120 nail~~[y]	~~Not allowed~~	~~Same as stud spacing~~
			~~Lap~~	~~Yes~~	~~0.120 nail 1 1/2″ long~~	~~0.120 nail 2″ long~~	~~0.120 nail 2″ long~~	~~0.120 nail~~[y]	~~Not allowed~~	
	~~With insulation~~	~~0.019~~	~~Lap~~	~~Yes~~	~~0.120 nail 1 1/2″ long~~	~~0.120 nail 2 1/2″ long~~	~~0.120 nail 2 1/2″ long~~	~~0.120 nail~~[y]	~~0.120 nail 1 1/2″ long~~	
~~Anchored veneer: brick, concrete, masonry or stone~~		~~2~~	~~Section R703~~	~~Yes~~	~~See Section R703 and Figure R703.7~~[g]					
~~Adhered veneer: concrete, stone or masonry~~[w]		—	~~Section R703~~	~~Yes Note w~~	~~See Section R703.6.1~~[g] ~~or in accordance with the manufacturer's instructions.~~					
~~Hardboard~~[k] ~~Panel siding-vertical~~		~~7/16~~	—	~~Yes~~	~~Note m~~	~~Note m~~	~~Note m~~	~~Note m~~	~~Note m~~	~~6″ panel edges 12″ inter. sup.~~[n]
~~Hardboard~~[k] ~~Lap-siding-horizontal~~		~~7/16~~	~~Note p~~	~~Yes~~	~~Note o~~	~~Note o~~	~~Note o~~	~~Note o~~	~~Note o~~	~~Same as stud spacing 2 per bearing~~
~~Steel~~[h]		~~29 ga.~~	~~Lap~~	~~Yes~~	~~0.113 nail 1 3/4″ Staple 1 3/4″~~	~~0.113 nail 2 3/4″ Staple 2 1/2″~~	~~0.113 nail 2 1/2″ Staple 2 1/4″~~	~~0.113 nail~~[y] ~~Staple~~[y]	~~Not allowed~~	~~Same as stud spacing~~
~~Particleboard panels~~		~~3/8—1/2~~	—	~~Yes~~	~~6d box nail (2″ × 0.099″)~~	~~6d box nail (2″ × 0.099″)~~	~~6d box nail (2″ × 0.099″)~~	~~box nail~~[y]	~~6d box nail (2″ × 0.099″), 3/8 not allowed~~	~~6″ panel edge, 12" inter. sup.~~
		~~5/8~~	—	~~Yes~~	~~6d box nail (2″ × 0.099″)~~	~~8d box nail (2 1/2″ × 0.113″)~~	~~8d box nail (2 1/2″ × 0.113″)~~	~~box nail~~[y]	~~6d box nail (2″" × 0.099″)~~	
~~Wood structural panel~~[i] ~~ANSI/APA-PRP 210 siding~~[i] ~~(exterior grade)~~		~~3/8—1/2~~	~~Note p~~	~~Yes~~	~~0.099 nail-2″~~	~~0.113 nail-2 1/2″~~	~~0.113 nail-2 1/2″~~	~~0.113 nail~~[y]	~~0.099 nail-2″~~	~~6″ panel edges, 12″ inter. sup.~~
~~Wood structural panel lapsiding~~		~~3/8—1/2~~	~~Note p Note x~~	~~Yes~~	~~0.099 nail-2″~~	~~0.113 nail-2 1/2″~~	~~0.113 nail-2 1/2″~~	~~0.113 nail~~[x]	~~0.099 nail-2″~~	~~8″ along bottom edge~~
~~Vinyl siding~~[l]		~~0.035~~	~~Lap~~	~~Yes~~	~~0.120 nail (shank) with a 0.313 head or 16-gage staple with 3/8-to 1/2-inch crown~~[y, z]	~~0.120 nail (shank) with a 0.313 head or 16-gage staple with 3/8-to 1/2-inch crown~~[y]	~~0.120 nail (shank) with a 0.313 head or 16-gage staple with 3/8-to 1/2-inch crown~~[y]	~~0.120 nail (shank) with a 0.313 head per Section R703.11.2~~	~~Not allowed~~	~~16 inches on center or specified by the manufacturer instructions or test report~~

~~SIDING MATERIAL~~		~~NOMINAL THICKNESS[a] (inches)~~	~~JOINT TREATMENT~~	~~WATER-RESISTIVE BARRIER REQUIRED~~	~~TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[b, c, d]~~					
					~~Wood or wood structural panel sheathing into stud~~	~~Fiberboard sheathing into stud~~	~~Gypsum sheathing into stud~~	~~Foam plastic sheathing into stud~~	~~Direct to studs~~	~~Number or spacing of fasteners~~
~~Wood[j] rustic, drop~~	~~$^{3}/_{8}$ Min~~	~~Lap~~	~~Yes~~	~~Fastener penetration into stud 1″~~					~~0.113 nail $2^{1}/_{2}$″ Staple 2″~~	~~Face nailing up to 6″ widths, 1 nail per bearing; 8″ widths and over, 2 nails per bearing~~
~~Shiplap~~	~~$^{19}/_{32}$ Average~~	~~Lap~~	~~Yes~~	~~Fastener penetration into stud 1″~~					~~0.113 nail $2^{1}/_{2}$″ Staple 2″~~	~~Face nailing up to 6″ widths, 1 nail per bearing; 8″ widths and over, 2 nails per bearing~~
~~Bevel~~	~~$^{7}/_{16}$~~									
~~Butt tip~~	~~$^{3}/_{16}$~~	~~Lap~~	~~Yes~~							
~~Fiber cement panel siding[q]~~	~~$^{5}/_{16}$~~	~~Note q~~	~~Yes Note u~~	~~6d common corrosion-resistant nail[r]~~		~~6d common corrosion-resistant nail[r]~~	~~6d common corrosion-resistant nail[r]~~	~~6d common corrosion-resistant nail[r, v]~~	~~4d common corrosion-resistant nail[r]~~	~~6″ o.c. on edges, 12″ o.c. on intermed. studs~~
~~Fiber cement lap siding[s]~~	~~$^{5}/_{16}$~~	~~Note s~~	~~Yes Note u~~	~~6d common corrosion-resistant nail[r]~~		~~6d common corrosion-resistant nail[r]~~	~~6d common corrosion-resistant nail[r]~~	~~6d common corrosion-resistant nail[r, v]~~	~~6d common corrosion-resistant nail or 11 gage roofing nail[r]~~	~~Note t~~

~~For SI: 1 inch = 25.4 mm.~~

~~a. Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.~~

~~b. Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.~~

~~c. Staples shall have a minimum crown width of $^{7}/_{16}$-inch outside diameter and be manufactured of minimum 16-gage wire.~~

~~d. Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs where fiberboard, gypsum, or foam plastic sheathing backing is used. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with the siding manufacturer's installation instructions.~~

~~e. Aluminum nails shall be used to attach aluminum siding.~~

~~f. Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.~~

~~g. All attachments shall be coated with a corrosion-resistant coating.~~

~~h. Shall be of approved type.~~

~~i. Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood $^{1}/_{2}$-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.~~

~~j. Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate $1^{1}/_{2}$ inches into studs, studs and wood sheathing combined or blocking.~~

~~k. Hardboard siding shall comply with CPA/ANSI A135.6.~~

~~l. Vinyl siding shall comply with ASTM D 3679.~~

~~m. Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing $1^{1}/_{2}$ inches.~~

~~n. When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.~~

~~o. Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.~~

~~p. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.~~

~~q. See Section R703.10.1.~~

~~r. Fasteners shall comply with the nominal dimensions in ASTM F 1667.~~

~~s. See Section R703.10.2.~~

~~t. Face nailing: one 6d common nail through the over lap ping planks at each stud. Concealed nailing: one 11 gage $1^1/_2$ inch long galv. roofing nail through the top edge of each plank at each stud.~~

~~u. See Section R703.2 exceptions.~~

~~v. Minimum nail length must accommodate sheathing and penetrate framing $1^1/_2$ inches.~~

~~w. Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of TMS-402 ACI 530/ASCE 5.~~

~~x. Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.~~

~~y. Minimum fastener length must accommodate sheathing and penetrate framing 0.75 inches or in accordance with the manufacturer's installation instructions.~~

Reason: The purpose of this code change is to replace the existing Table R703.4 with a revised and simplified version and improve the code text relating to siding attachment. While reviewing several code change proposals last cycle dealing with siding attachment, we identified a number of conflicts between the table and code text, as well as discovering several errata. Additionally, we found the 2009 IRC version of the table hard to work with because of the small font and the extensive footnotes. The 2012 version of the table was printed in a larger font in an effort to improve readability, but this has not fixed all of the issues and we have identified new errata. This code change replaces the table with a new version and introduces new charging language and additional code revisions to move material from footnotes to the main body of the code where they can be more easily located. The key changes are as follows:

(1) Existing Section R703.4 is clarified and revised. The nail requirement is relocated to a new subsection. Footnote (a) is moved to the section. The entire section is moved to become R703.3, placing it immediately following the WRB section ahead of the wood siding section.
(2) To the extent possible, nail specifications are formatted to match the standard used in Table R602.3(1) and elsewhere, where the nail type is specified, followed by the length x shank diameter.
(3) A new Section R703.3.2 on fasteners combines existing footnotes (b), (c), (d), (g) and (r). It is noted all nails and staples need to comply with ASTM F 1667, not just those for fiber-cement siding.
(4) Footnotes (i) and (j) are moved to the existing section on wood, hardboard and wood structural panel siding. Separate subsections are created for the requirements relevant to horizontal wood siding, vertical wood siding, and panel siding products. Minimum fastener size and minimum penetration requirements, along with other installation details, are coordinated with current installation guides such as those available from WRCLA or WWPA.
(5) The existing footnote (k) reference to the hardboard siding standard is moved to Section R703.5 (formerly Section R703.3).
(6) The existing footnote (l) reference to the vinyl siding standard is not needed as the standard is called out in Section R703.11. A pointer is added under the material listing.
(7) A new Section R703.3.3 is created dealing with fastener length and penetration. The penetration requirements from footnotes (m) and (o) for hardboard siding and footnotes (v), (y), and (z) are moved to items under this new section.
(8) The shank and head diameters in footnotes (m) and (o) for hardboard siding are moved into Table.R703.3.
(9) The fiber-cement section references from existing footnotes (q) and (s) are provided under the respective material listings. The shank diameter and length for the 6d common nail is provided. The "corrosion-resistant nail" language is removed since it is already required by the charging language for Table R703.3 (formerly Table R703.4).
(10) The "water-resistive barrier required" column is deleted. As of the 2012 IRC, all the products in Table R703.4 required a WRB unless covered by the exceptions under Section R703.2 for detached accessory buildings and for certain paper-backed stucco lath products. Since Section R703.2 always applies, existing footnote (u) is redundant.
(11) The existing footnote (w) reference to TMS 402 is relocated to the adhered veneer section.

Cost Impact: The code change proposal will not increase the cost of construction.

RB392-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB393 – 13

R802.1, R802.1.1, R802.1.2, R802.1.3, R802.1.3.1, R802.1.3.2, R802.1.3.3, R802.1.3.4, R802.1.3.5, R802.1.3.5.1, R802.1.3.5.2, R802.1.3.6, R802.1.3.7, R802.1.3.8, R802.1.4, R802.1.5, R802.1.6,

Proponent: Dennis Pitts, American Wood Council (dpitts@awc.org)

Revise as follows:

R802.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R802.1.1 ~~Identification~~ Sawn Lumber. ~~Load-bearing dimension lumber for rafters, trusses and ceiling joists~~ Sawn lumber shall be identified by a grade mark of an accredited lumber grading or inspection agency and have design values certified by ~~that has been approved by~~ an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

~~**R802.1Blocking.** Blocking shall be a minimum of utility grade lumber.~~

~~**R802.1.2**~~ **R802.1.1.1 End-jointed lumber.** *Approved* end-jointed lumber identified by a grade mark conforming to Section R802.1.1 may be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a fire-resistance rating shall have the designation “Heat-Resistant Adhesive” or “HRA” included in its grade mark.

~~**R802.1.4**~~ **R802.1.2 Structural glued laminated timbers.** Glued laminated timbers shall be manufactured and identified as required in ANSI/AITC A190.1 and ASTM D 3737.

~~**R802.1.5**~~ **R802.1.3 Structural log members.** Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an *approved* lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber-grading or inspection agency meeting the requirements of this section shall be permitted to be accepted**.**

~~**R802.1.6**~~ **R802.1.4 Structural composite lumber.** Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D 5456.

~~**R802.1.3**~~ **R802.1.5 Fire-retardant-treated wood.** Fire-retardant treated wood (FRTW) is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84 or UL 723, a listed flame spread index of 25 or less and shows no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

~~**R802.1.3.1**~~ **R802.1.5.1 Pressure process.** For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

~~**R802.1.3.2**~~ **R802.1.5.2 Other means during manufacture.** For wood products produced by other means during manufacture the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product.

~~**R802.1.3.3**~~ **R802.1.5.3 Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section R802.1.3. Testing of only the front and back faces of wood structural panels shall be permitted.

~~**R802.1.3.4**~~ **R802.1.5.4 Labeling.** Fire-retardant-treated lumber and wood structural panels shall be *labeled.* The *label* shall contain:

1. The identification *mark* of an *approved agency* in accordance with Section 1703.5 of the *International Building Code.*
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections ~~R802.1.3.5~~ R802.1.5.5 through ~~R802.1.3.8~~ R802.1.5.10.
8. For FRTW exposed to weather, or a damp or wet location, the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D 2898).

~~**R802.1.3.5**~~ **R802.1.5.5 Strength adjustments.** Design values for untreated lumber and wood structural panels as specified in Section R802.1 shall be adjusted for fire-retardant- treated wood. Adjustments to design values shall be based upon an *approved* method of investigation which takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant- treated wood will be subjected, the type of treatment and redrying procedures.

~~**R802.1.3.5.1**~~ **R802.1.5.6 Wood structural panels.** The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant- treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

~~**R802.1.3.5.2**~~ **R802.1.5.7 Lumber.** For each species of wood treated, the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D 6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

~~**R802.1.3.6**~~ **R802.1.5.8 Exposure to weather.** Where fire-retardant- treated wood is exposed to weather or damp or wet locations, it shall be identified as “Exterior” to indicate there is no increase in the listed flame spread index as defined in Section ~~R802.1.3~~ R802.1.5 when subjected to ASTM D 2898.

~~**R802.1.3.7**~~ **R802.1.5.9 Interior applications.** Interior fire-retardant- treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D 3201 procedures at 92 percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section ~~R802.1.3.5.1~~ R802.1.3.5.6 or ~~R802.1.3.5.2~~ R802.1.3.5.7. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

~~**R802.1.3.8**~~ **R802.1.5.10 Moisture content.** Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section ~~R802.1.3.5.1~~ R802.1.5.6 for plywood and ~~R802.1.3.5.2~~ R802.1.5.7 for lumber.

~~R802.1~~ R802.3.3 Blocking. Blocking shall be a minimum of utility grade lumber.

Reason: The change is intended to clarify the process by which lumber design values are certified and recognized in the code. The current process, which has been used since 1970, relies on the internationally recognized U.S.Department of Commerce Voluntary Product Standard PS20. Because the current format of the section can be incorrectly interpreted to place a number of wood products under the identification requirements of PS20, a new format is proposed that clearly states this standard is only for sawn lumber. The format proposed is nearly identical to what is used in Section 2302 of the International Building Code. Wood products other than sawn lumber have unique manufacturing standards, design value development, and quality control criteria. This new format clarifies that these other wood products must comply with specific product standards.

Cost Impact: The code change proposal will not increase the cost of construction.

RB393-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.1 (NEW)-RB-PITTS.doc

RB394 – 13
R802.3

Proponent: Tim Swanson, City of Greeley, representing Colorado Chapter of the International Code Council (tim.swanson@greeleygov.com)

Revise as follows:

R802.3 Framing details. Rafters shall be framed directly opposite each other to ridge board or directly opposite ~~or to~~ each other with a gusset plate as a tie. Ridge board shall be at least 1-inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25-percent slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

Reason: The language in the current IRC would allow rafters to be staggered at the ridge board, does that maintain structural integrity? It also does not give any guidance as to how the rafters are configured when joined with a gusset plate. Are they stacked? Side by side? We can assume that the code intends for them to be opposed with the gusset plate, but that requirement is not given. This code change reflects the intent and language currently in the IBC with minimal changes to the text of the IRC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB394-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB395 – 13
Table R602.3(1), R802.3.1, Figure 802.5.1

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a,b,c]	SPACING OF FASTENERS
Roof			
~~4~~	~~Collar tie to rafter, face nail or 1 ¼" x 20 gage ridge strap~~	~~3-10d (3" x 0.128")~~	~~-~~

(Portions of Table not shown remain unchanged)

Revise as follows:

R802.3.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other in accordance with Table R802.5.1(9)~~,~~ to provide a continuous tie across the building. ~~and the rafter~~ Rafters and ceiling joists shall be nailed to the top wall plate in accordance with Table R602.3(1). Ceiling joists shall be continuous or ~~securely~~ joined in accordance with Table R802.5.1(9). ~~where they meet over interior partitions and are nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.~~ Laps or butts of ceiling joists shall be in accordance with Section R802.3.2.

~~Where ceiling joists are not connected to the rafters at the top wall plate, joists connected higher in the *attic* shall be installed as rafter ties, or rafter ties shall be installed to provide a continuous tie. Where ceiling joists are not parallel to rafters, rafter ties shall be installed. Rafter ties shall be a minimum of 2 inches by 4 inches (51 mm by 102 mm) (nominal), installed in accordance with the connection requirements in Table R802.5.1(9), or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided, the ridge formed by these rafters shall be supported by a wall or girder designed in accordance with accepted engineering practice.~~

~~Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the *attic* space in accordance with Table R602.3(1).~~

~~Collar ties shall be a minimum of 1 inch by 4 inches (25 mm by 102 mm) (nominal), spaced not more than 4 feet (1219 mm) on center.~~

Where ceiling joists are connected to rafters above the top wall plate, they shall also meet the requirements for rafter ties. Where ceiling joists run perpendicular to rafters, rafter ties shall be installed. Rafter ties shall be a minimum of 2 inches by 4 inches (51 mm by 102 mm) (nominal) and be installed in accordance with Figure R802.5.1 and the connection requirements in Table R802.5.1(9).

Where ceiling joists or rafter ties are not provided, the ridge formed by these rafters shall be supported by a wall or girder designed in accordance with accepted engineering practice.

Delete without substitution:

Delete references to "collar tie" in Figure R802.5.1

Reason: The current language is confusing to read. It contains unnecessary repetition.

In the first paragraph, the first and last sentences are combined. Language is inserted to address the connection of ceiling joists to the top plate. The word "securely" is being deleted as ceiling joists joined per the code are presumed to be secure. Laps or butts are already regulated in R802.3.2.

Specific direction on rafter ties has been editorially revised so it is more easily understood.

References to "collar ties" are being deleted because there is no place in the IRC that makes collars ties a requirement. The sentences says "Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space in accordance with Table R602.3(1)." The code says where they are to be connected, not when they are required. Something is missing. This text first appeared in the 2006 IRC but there isn't a valid explanation in ICC guides or manuals. Collar ties were not part of any previous I-Code. Why have rules for components that are not required? Such rules are unenforceable.

Cost Impact: The code change proposal will not increase the cost of construction.

RB395-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.3.1-RB-DAVIDSON.doc

RB396 – 13
R802.10.2.1, R802.11.1, Table R802.11

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R802.10.2.1 Applicability limits. The provisions of this section shall control the design of truss roof framing when snow controls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span, not more than three stories above grade plane in height, and roof slopes not smaller than 3:12 (25 percent slope) or greater than 12:12 (100 percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 140 ~~110~~ miles per hour (63~~49~~ m/s), Exposure A, B or C, and a maximum ground snow load of 70 psf (3352 Pa). For consistent loading of all truss types, roof snow load is to be computed as: 0.7 p_g.

R802.11.1 Uplift resistance. Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1.2 and R802.11.1.3.

Where the uplift force does not exceed 200 pounds, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

Where the basic wind speed does not exceed 115 mph ~~90 mph~~, the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

~~TABLE R802.11~~
~~RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (POUNDS PER CONNECTION)[a, b, c, d, e, f, g, h]~~

~~RAFTER OR TRUSS SPACING~~	~~ROOF SPAN (feet)~~	~~EXPOSURE B~~							
		~~Basic Wind Speed (mph)~~							
		~~85~~		~~90~~		~~100~~		~~110~~	
		~~Roof Pitch~~		~~Roof Pitch~~		~~Roof Pitch~~		~~Roof Pitch~~	
		~~< 5:12~~	~~≥ 5:12~~	~~< 5:12~~	~~≥ 5:12~~	~~< 5:12~~	~~≥ 5:12~~	~~< 5:12~~	~~≥ 5:12~~
~~12″ o.c.~~	~~12~~	~~47~~	~~41~~	~~62~~	~~54~~	~~93~~	~~81~~	~~127~~	~~110~~
	~~18~~	~~59~~	~~51~~	~~78~~	~~68~~	~~119~~	~~104~~	~~165~~	~~144~~
	~~24~~	~~70~~	~~61~~	~~93~~	~~81~~	~~145~~	~~126~~	~~202~~	~~176~~
	~~28~~	~~77~~	~~67~~	~~104~~	~~90~~	~~163~~	~~142~~	~~227~~	~~197~~
	~~32~~	~~85~~	~~74~~	~~115~~	~~100~~	~~180~~	~~157~~	~~252~~	~~219~~
	~~36~~	~~93~~	~~81~~	~~126~~	~~110~~	~~198~~	~~172~~	~~277~~	~~241~~
	~~42~~	~~105~~	~~91~~	~~143~~	~~124~~	~~225~~	~~196~~	~~315~~	~~274~~
	~~48~~	~~116~~	~~101~~	~~159~~	~~138~~	~~251~~	~~218~~	~~353~~	~~307~~
~~16″ o.c.~~	~~12~~	~~63~~	~~55~~	~~83~~	~~72~~	~~124~~	~~108~~	~~169~~	~~147~~
	~~18~~	~~78~~	~~68~~	~~103~~	~~90~~	~~159~~	~~138~~	~~219~~	~~191~~

	~~24~~	~~93~~	~~81~~	~~124~~	~~108~~	~~193~~	~~168~~	~~269~~	~~234~~
	~~28~~	~~102~~	~~89~~	~~138~~	~~120~~	~~217~~	~~189~~	~~302~~	~~263~~
	~~32~~	~~113~~	~~98~~	~~153~~	~~133~~	~~239~~	~~208~~	~~335~~	~~291~~
	~~36~~	~~124~~	~~108~~	~~168~~	~~146~~	~~264~~	~~230~~	~~369~~	~~321~~
	~~42~~	~~139~~	~~121~~	~~190~~	~~165~~	~~299~~	~~260~~	~~420~~	~~365~~
	~~48~~	~~155~~	~~135~~	~~212~~	~~184~~	~~335~~	~~291~~	~~471~~	~~410~~
~~24″ o.c.~~	~~12~~	~~94~~	~~82~~	~~124~~	~~108~~	~~186~~	~~162~~	~~254~~	~~221~~
	~~18~~	~~117~~	~~102~~	~~155~~	~~135~~	~~238~~	~~207~~	~~329~~	~~286~~
	~~24~~	~~140~~	~~122~~	~~186~~	~~162~~	~~290~~	~~252~~	~~404~~	~~351~~
	~~28~~	~~154~~	~~134~~	~~208~~	~~181~~	~~326~~	~~284~~	~~454~~	~~395~~
	~~32~~	~~170~~	~~148~~	~~230~~	~~200~~	~~360~~	~~313~~	~~504~~	~~438~~
	~~36~~	~~186~~	~~162~~	~~252~~	~~219~~	~~396~~	~~345~~	~~554~~	~~482~~
	~~42~~	~~209~~	~~182~~	~~285~~	~~248~~	~~449~~	~~391~~	~~630~~	~~548~~
	~~48~~	~~232~~	~~202~~	~~318~~	~~277~~	~~502~~	~~437~~	~~706~~	~~614~~
~~RAFTER OR TRUSS SPACING~~	**~~ROOF SPAN (feet)~~**	**~~EXPOSURE C~~**							
		~~Basic Wind Speed (mph)~~							
		~~85~~		**~~90~~**		**~~100~~**		**~~110~~**	
		~~Roof Pitch~~		**~~Roof Pitch~~**		**~~Roof Pitch~~**		**~~Roof Pitch~~**	
		~~< 5:12~~	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**
~~12″ o.c.~~	~~12~~	~~94~~	~~82~~	~~114~~	~~99~~	~~157~~	~~137~~	~~206~~	~~179~~
	~~18~~	~~120~~	~~104~~	~~146~~	~~127~~	~~204~~	~~177~~	~~268~~	~~233~~
	~~24~~	~~146~~	~~127~~	~~179~~	~~156~~	~~251~~	~~218~~	~~330~~	~~287~~
	~~28~~	~~164~~	~~143~~	~~201~~	~~175~~	~~283~~	~~246~~	~~372~~	~~324~~
	~~32~~	~~182~~	~~158~~	~~224~~	~~195~~	~~314~~	~~273~~	~~414~~	~~360~~
	~~36~~	~~200~~	~~174~~	~~246~~	~~214~~	~~346~~	~~301~~	~~456~~	~~397~~
	~~42~~	~~227~~	~~197~~	~~279~~	~~243~~	~~394~~	~~343~~	~~520~~	~~452~~
	~~48~~	~~254~~	~~221~~	~~313~~	~~272~~	~~441~~	~~384~~	~~583~~	~~507~~
~~RAFTER OR TRUSS SPACING~~	**~~ROOF SPAN (feet)~~**	**~~EXPOSURE C~~**							
		~~Basic Wind Speed (mph)~~							
		~~85~~		**~~90~~**		**~~100~~**		**~~110~~**	
		~~Roof Pitch~~		**~~Roof Pitch~~**		**~~Roof Pitch~~**		**~~Roof Pitch~~**	
		~~< 5:12~~	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**	**~~< 5:12~~**	**~~≥ 5:12~~**
~~16″ o.c.~~	~~12~~	~~125~~	~~109~~	~~152~~	~~132~~	~~209~~	~~182~~	~~274~~	~~238~~
	~~18~~	~~160~~	~~139~~	~~194~~	~~169~~	~~271~~	~~236~~	~~356~~	~~310~~

	~~24~~	~~194~~	~~169~~	~~238~~	~~207~~	~~334~~	~~291~~	~~439~~	~~382~~
	~~28~~	~~218~~	~~190~~	~~267~~	~~232~~	~~376~~	~~327~~	~~495~~	~~431~~
	~~32~~	~~242~~	~~211~~	~~298~~	~~259~~	~~418~~	~~364~~	~~551~~	~~479~~
	~~36~~	~~266~~	~~231~~	~~327~~	~~284~~	~~460~~	~~400~~	~~606~~	~~527~~
	~~42~~	~~302~~	~~263~~	~~372~~	~~324~~	~~524~~	~~456~~	~~691~~	~~601~~
	~~48~~	~~338~~	~~294~~	~~416~~	~~362~~	~~587~~	~~511~~	~~775~~	~~674~~
~~24″ o.c.~~	~~12~~	~~188~~	~~164~~	~~228~~	~~198~~	~~314~~	~~273~~	~~412~~	~~358~~
	~~18~~	~~240~~	~~209~~	~~292~~	~~254~~	~~408~~	~~355~~	~~536~~	~~466~~
	~~24~~	~~292~~	~~254~~	~~358~~	~~311~~	~~502~~	~~437~~	~~660~~	~~574~~
	~~28~~	~~328~~	~~285~~	~~402~~	~~350~~	~~566~~	~~492~~	~~744~~	~~647~~
	~~32~~	~~364~~	~~317~~	~~448~~	~~390~~	~~628~~	~~546~~	~~828~~	~~720~~
	~~36~~	~~400~~	~~348~~	~~492~~	~~428~~	~~692~~	~~602~~	~~912~~	~~793~~
	~~42~~	~~454~~	~~395~~	~~558~~	~~485~~	~~786~~	~~684~~	~~1040~~	~~905~~
	~~48~~	~~508~~	~~442~~	~~626~~	~~545~~	~~882~~	~~767~~	~~1166~~	~~1014~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 0.454 kg, 1 pound per linear foot = 14.5 N/m.~~

a. ~~The uplift connection forces are based on a maximum 33-foot mean roof height and Wind Exposure Category B or C. For Exposure D, the uplift connection force shall be selected from the Exposure C portion of the table using the next highest tabulated basic wind speed. The Adjustment Coefficients in Table R301.2(3) shall not be used to multiply the above forces for Exposures C and D or for other mean roof heights.~~

b. ~~The uplift connection forces include an allowance for roof and ceiling assembly dead load of 15 psf.~~

c. ~~The tabulated uplift connection forces are limited to a maximum roof overhang of 24 inches.~~

d. ~~The tabulated uplift connection forces shall be permitted to be multiplied by 0.75 for connections not located within 8 feet of building corners.~~

e. ~~For buildings with hip roofs with 5:12 and greater pitch, the tabulated uplift connection forces shall be permitted to be multiplied by 0.70. This reduction shall not be combined with any other reduction in tabulated forces.~~

f. ~~For wall-to-wall and wall-to-foundation connections, the uplift connection force shall be permitted to be reduced by 60 plf for each full wall above.~~

g. ~~Linear interpolation between tabulated roof spans and wind speeds shall be permitted.~~

h. ~~The tabulated forces for a 12-inch on-center spacing shall be permitted to be used to determine the uplift load in pounds per linear foot.~~

TABLE R802.11
RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD)(POUNDS PER CONNECTION) [a, b, c, d, e, f, g, h]

RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B									
		Ultimate Design Wind Speed, V_{ULT} (mph)									
		110		115		120		130		140	
		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch	
		<5:12	≥5:12	<5:12	≥5:12	<5:12	≥5:12	<5:12	≥5:12	<5:12	≥5:12
12" o.c.	12	48	32	59	42	70	52	95	73	122	97
	18	59	42	74	55	89	69	122	98	157	129
	24	71	52	89	69	108	86	149	123	192	162
	28	79	59	99	78	121	97	167	139	216	184
	32	86	66	109	87	134	109	185	156	240	206
	36	94	72	120	96	146	120	203	172	264	229
	42	106	83	135	109	166	138	230	197	300	262
	48	118	93	151	123	185	155	258	222	336	295

16" o.c.	12	64	43	78	56	93	69	126	97	162	129
	18	78	56	98	73	118	92	162	130	209	172
	24	94	69	118	92	144	114	198	164	255	215
	28	105	78	132	104	161	129	222	185	287	245
	32	114	88	145	116	178	145	246	207	319	274
	36	125	96	160	128	194	160	270	229	351	305
	42	141	110	180	145	221	184	306	262	399	348
	48	157	124	201	164	246	206	343	295	447	392
24" o.c.	12	96	64	118	84	140	104	190	146	244	194
	18	118	84	148	110	178	138	244	196	314	258
	24	142	104	178	138	216	172	298	246	384	324
	28	158	118	198	156	242	194	334	278	432	368
	32	172	132	218	174	268	218	370	312	480	412
	36	188	144	240	192	292	240	406	344	528	458
	42	212	166	270	218	332	276	460	394	600	524
	48	236	186	302	246	370	310	516	444	672	590
RAFTER OR TRUSS SPACING	**ROOF SPAN (feet)**	**EXPOSURE C**									
		Ultimate Design Wind Speed, V_{ULT} (mph)									
		110		**115**		**120**		**130**		**140**	
		Roof Pitch		**Roof Pitch**		**Roof Pitch**		**Roof Pitch**		**Roof Pitch**	
		<5:12	**≥5:12**	**<5:12**	**<5:12**	**<5:12**	**≥5:12**	**<5:12**	**≥5:12**	**<5:12**	**≥5:12**
12" o.c.	12	95	73	110	86	126	100	161	130	198	163
	18	121	97	141	115	163	135	208	175	257	219
	24	148	122	173	145	200	169	256	220	317	275
	28	166	138	195	164	225	192	289	250	358	313
	32	184	155	216	184	249	215	321	280	398	351
	36	202	171	237	204	274	238	353	310	438	389
	42	229	196	269	233	312	273	402	356	499	446
	48	256	221	302	263	349	307	450	401	560	503
16" o.c.	12	126	97	146	114	168	133	214	173	263	217
	18	161	129	188	153	217	180	277	233	342	291
	24	197	162	230	193	266	225	340	293	422	366
	28	221	184	259	218	299	255	384	333	476	416
	32	245	206	287	245	331	286	427	372	529	467
	36	269	227	315	271	364	317	469	412	583	517
	42	305	261	358	310	415	363	535	473	664	593
	48	340	294	402	350	464	408	599	533	745	669
24" o.c.	12	190	146	220	172	252	200	322	260	396	326
	18	242	194	282	230	326	270	416	350	514	438
	24	296	244	346	290	400	338	512	440	634	550
	28	332	276	390	328	450	384	578	500	716	626
	32	368	310	432	368	498	430	642	560	796	702
	36	404	342	474	408	548	476	706	620	876	778
	42	458	392	538	466	624	546	804	712	998	892
	48	512	442	604	526	698	614	900	802	1120	1006

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mph = 0.447 m/s, 1 pound = 0.454 kg.

a. The uplift connection forces are based on a maximum 33 foot mean roof height and Wind Exposure Category B or C. For Exposure D, the uplift connection force shall be selected from the Exposure C portion of the table using the next highest tabulated ultimate design wind speed. The Adjustment Coefficients in Table R301.2(3) shall not be used to multiply the above forces for Exposures C and D or for other mean roof heights.

b. The uplift connection forces include an allowance for roof and ceiling assembly dead load of 15 psf.
c. The tabulated uplift connection forces are limited to a maximum roof overhang of 24 inches.
d. The tabulated uplift connection forces shall be permitted to be multiplied by 0.75 for connections not located within 8 feet of building corners.
e. For buildings with hip roofs with 5:12 and greater pitch, the tabulated uplift connection forces shall be permitted to be multiplied by 0.70. This reduction shall not be combined with any other reduction in tabulated forces.
f. For wall-to-wall and wall-to-foundation connections, the uplift connection force shall be permitted to be reduced by 60 plf for each full wall above.
g. Linear interpolation between tabulated roof spans and wind speeds shall be permitted.
h. The tabulated forces for a 12" on center spacing shall be permitted to be used to determine the uplift load in pounds per linear foot.

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates Chapter 8, including wood truss applicability limits and roof uplift connection provisions. It is noted that the changes necessary to update the appropriate Section R804 cold-formed steel provisions are contained in a separate AISI proposal which comprehensively revises the cold-formed steel provisions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB396-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.10.2.1-RB-EHRLICH.doc

RB397 – 13
R802.11.1.2

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R802.11.1.2 Truss uplift resistance. Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the Truss Design Drawings for the basic wind speed as determined by Figure R301.2(4)A and listed in Table R301.2(1). Uplift forces shall be permitted to be determined as specified by Table R802.11, if applicable, or as determined by accepted engineering practice.

Reason: The purpose of this code change is to clarify the requirements for determining uplift loads for trusses. The proposal adds a pointer to the Climatic and Geographic Design Criteria table and the Basic Wind Speed figure. This emphasizes the need for the Truss Designer to correctly select the proper wind speed and other criteria for the site and building in the truss design software and not just pick the highest wind speed applicable in a state or the highest mean roof height permitted. It is critical the Truss Design Drawings reflect the correct uplift reactions for the site and building in question and not a more conservative reaction. Otherwise, the builder (and homeowner) would be required to install extra (or larger) uplift connectors than would normally be necessary for the loads anticipated at the site.

Cost Impact: The code change proposal will not increase the cost of construction.

RB397-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.11.1.2-RB-EHRLICH.doc

RB398 – 13
R602.3.5, R802.11.1

Proponent: Andrew Herseth, US Dept of Homeland Security, representing Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R602.3.5 Braced wall panel uplift load path. Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
   1.1. The basic wind speed does not exceed 90 mph (40 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is ~~32~~ 20 feet (~~9754~~ 6096 mm) or less, or
   1.2. The net uplift value at the top of a wall does not exceed ~~100~~ 70 plf (102 N/mm) . (The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.
2. Where the net uplift value at the top of a wall exceeds ~~100~~ 70 plf (~~146~~ 102 N/mm), installing approved uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is ~~100~~ 70 plf (~~146~~ 102 N/mm) or less. The net uplift value shall be as determined in Item 1.2 above.
3. Wall sheathing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.

Revise as follows:

R802.11 Roof tie-down.

R802.11.1 Uplift resistance. Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1.2 and R802.11.1.3.

Where the uplift force does not exceed ~~200~~ 140 pounds, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

Where the basic wind speed does not exceed 90 mph, the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is ~~32~~ 20 feet (~~9754~~ 6096 mm) or less, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

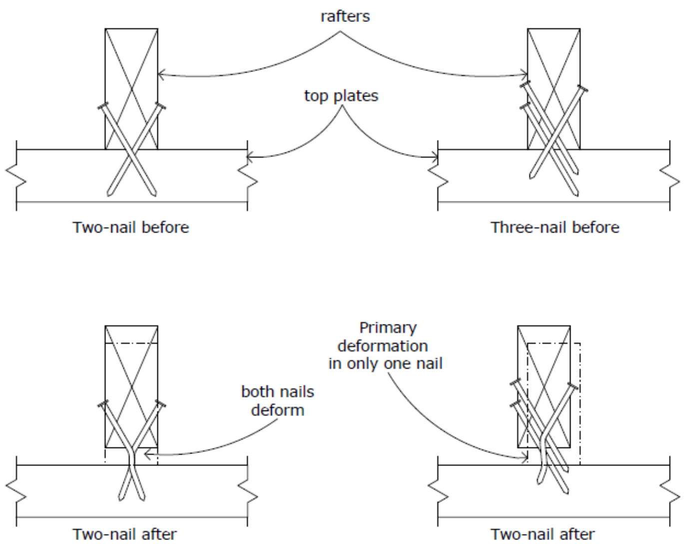
Exception: When the roof framing and top plates are of Douglas Fir-Larch or Southern Pine lumber, and the uplift force does not exceed 200 pounds, rafters and trusses are permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

Reason: The purpose of this proposal is to modify IRC roof tie-down provisions to reflect research that affect assumptions supporting the existing roof tie-down provisions.

As background, wood frame roof to wall load path failure has been observed on numerous post-disaster observations. The MAT Report from Hurricane Ivan (2004) – which was not considered to be a design wind event when evaluating wind speeds and wind pressures from the 2001 FBC or the 2000/2003 IBC and IRC – notes “the most prevalent construction type experiencing structural damage was residential wood roof framing. Inadequate nailing of roof sheathing panels, gable end wall failures, and lack of properly installed wood framing connectors were the major factors in these structural failures.” The Spring 2011 Tornadoes MAT Report observed instances of residential roof to wall connection failure for EF 1 rated tornadoes where wind speeds were estimated between 86 and 110 miles per hour. That report notes that “metal connectors designed to transfer uplift forces from the rafter or truss to the wall below greatly enhance connectivity and were observed to outperform toe nail-only connections”. It further concluded that “The weak link most often identified as responsible for loss of roof structure was the roof-to-wall connection (Figures 4-18 through 4-22)”.

The calculations included in this reason statement show that the trigger in the IRC for enhanced connections is lower than can be justified by calculations or testing. Table R602.3(1), Item 5 requires that the rafter or roof truss be toenailed to the top plate with either 3-16d box nails or 3-10d common nails. Using the most common wood species for wall framing, Spruce-Pine-Fir, calculations show that the capacity of the roof to wall connection is 139 pounds for the 10d nails or 149 pounds for the 16d sinker nails. Yet the IRC is written so that an additional connection is not required unless the uplift exceeds 200 pounds, assuming that the prescriptive toenails can provide 200 pounds of uplift resistance. But a trigger of 200 pounds cannot be justified by the calculated capacity of the connection.

Further, new test data shows that the assumption used in developing the wind uplift trigger for the 2012 IRC is flawed. That assumption was that adding an additional toenail to the traditional minimum of two toenails would increase the uplift capacity by 50 percent. Recent testing of 100 four-rafter assemblies taken from actual houses showed that there is only a 30% increase in uplift capacity for three toenails versus two toenails. The investigators wrote in their journal article that when one toenail is driven from each side of the roof framing member, “both must yield for the nails to withdraw. However, in the three nail connection, two nails angle in from one side while the third nail is driven at an opposing angle from the other side. This imbalance in the resistance causes the single nail to yield before the double nails. A small lateral shift occurs in the connection as one nail yields and the other two primarily avoid yielding while only experiencing direct withdrawal.” See the following drawing for an illustration of this.



Suspected failure mechanism of two and three nail connections.

Taken together, the calculations and testing argue for a lower limit for the assumed capacity of three toenails in the IRC. As a companion to the roof framing anchorage, the wall anchorage trigger should similarly be adjusted to reflect the capacity of the minimum required sheathing and fastening.

Specific justification is provided for each part of this code change proposal.

Calculation of Withdrawal Capacity of IRC Rafter/Truss to Top Plate Nailing

IRC Table R602.3(1), Item 5 specifies a toenail connection of the rafter or truss to the top plate using either 3 - 16d box nails (3-1/2" × 0.135") or 3 - 10d common nails (3" × 0.148")

Calculate the withdrawal capacity of the three fasteners above for a Spruce-Pine-Fir top plate
Use DA-2 Design Aid for Toenail Connections, published by the American Wood Council
http://www.awc.org/pdf/DA2-Toenails.pdf

1 **3 - 16d box nails (3-1/2" × 0.135")**
From DA-2, Wp = 31 pounds per nail
Adjust using 1.6 load duration factor for wind
Connection Capacity: 3×31×1.6 = **148.8 pounds**

2 **3 - 10d common nails (3" × 0.148")**
From DA-2, Wp = 29 pounds per nail
Adjust using 1.6 load duration factor for wind
Connection Capacity: 3×29×1.6 = **139.2** pounds

Reference **Withdrawal** Design Values (Wp) for **Toe-Nailed** Connections[1,2]

in Sawn Lumber or SCL

Nail Type	Nail Diameter D in.	Nial Length L in.	L_s in.	L_m in.	G=0.67 Red Oak lbs	G=0.55 Mixed Maple Southern Pine lbs	G=0.5 Douglas Fir-Larch lbs	G=0.49 Douglas Fir-Larch (N) lbs	G=0.46 Douglas Fir(S) Hem-Fir(N) lbs	G=0.43 Hem-Fir lbs	G=0.42 Spruce-Pine-Fir lbs	G=0.37 Redwood (open grain) lbs	G=0.36 Eastern Softwoods Spruce-Pine-Fir (S) Western Cedars Western Woods lbs	G=0.35 Northern Species lbs
Box	0.099	2	0.67	1.07	41	25	20	19	16	14	13	9	9	8
	0.113	2.5	0.83	1.33	59	36	28	27	23	19	18	13	12	12
	0.128	3	1.00	1.60	80	49	39	37	31	26	25	18	17	16
	0.135	3.5	1.17	1.86	99	60	48	45	39	33	31	22	21	19
	0.148	4	1.33	2.13	124	76	60	57	48	41	38	28	26	24
	0.162	5	1.67	2.66	169	103	81	77	66	56	53	38	36	33
Common	0.113	2	0.67	1.07	47	29	23	22	18	16	15	11	10	9
	0.131	2.5	0.83	1.33	68	42	33	31	27	23	21	16	14	14
	0.148	3	1.00	1.60	93	57	45	42	36	31	29	21	20	18
	0.162	3.5	1.17	1.86	119	72	57	54	46	39	37	27	25	23
Sinker	0.099	2.125	0.71	1.13	44	27	21	20	17	15	14	10	9	9
	0.113	2.375	0.79	1.27	56	34	27	26	22	19	17	13	12	11
	0.120	2.875	0.96	1.53	72	44	35	33	28	24	22	16	15	14
	0.135	3.125	1.04	1.67	88	54	42	40	34	29	27	20	19	17
	0.148	3.250	1.08	1.73	101	61	48	46	39	33	31	23	21	20

1. Tabulated withdrawal design values (Wp) shall be multiplied by all applicable adjustment factors (see NDS Table 10.3.1). Tabulated withdrawal design values (Wp) have been multiplied by the toe-nail factor, C_{tn} = 0.67 as specified in NDS 11.5.4.1.
2. Tabulated withdrawal design values (Wp) are for toe-nailed connections with common wire, box and sinker nails (see NDS Appendix L) with side and main member thickness sufficient to provide complete embedment of the nail in the wood members

It is proposed to adjust the assumed uplift capacity of a prescriptive wall to be consistent with the value used in Section R802.11. The proposed 70 plf uplift trigger can be justified by calculating the uplift capacity of the minimum braced wall panel method, Method GB. Table R602.10.4 specifies fastening for Method GB with nails or screws spaced at 7" o.c. The AF and PA *Special Design Provisions for Wind and Seismic* lists an allowable shear capacity of a nailed shearwall of ½" gypsum wallboard of 75 pounds per foot. Assuming that the same fasteners can resist the same amount of uniform uplift force as they could in a uniform shear force, and adjusting by dividing by the 1.1 diaphragm factor, that gives a uniform uplift of 68.2 pounds per foot, which agrees with the proposed limit of 70 pounds per foot.

Bibliography:

DA 2 - Toenail Connections, **American Wood Council**

ANSI / AF&PA SDPWS-2008 - Special Design Provisions for Wind and Seismic, American Wood Council

Statistical and analytical models for roof components in existing light-framed wood structures, B. Shanmugam, B. Nielson, and D. Prevatt, as published in Engineering Structures

Cost Impact: The code change proposal will increase the cost of construction. Cost of construction will increase for some roof assemblies (dependent on spacing, span, wind speed, and exposure) where construction includes Spruce-Pine Fir top plates. For smaller roof spans or where Douglas Fir-Larch or Southern Pine top plates are installed (or substituted), there will be no cost impact.

RB398-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.11.1-RB-HERSETH-OVERCASH.doc

RB399 – 13
R802.11, R802.11.1, R802.11.1.4 (NEW)

Proponent: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee and American Chemistry Council (jcrandell@aresconsulting.biz)

Revise as follows:

R802.11 Roof <u>uplift load path</u> ~~tie-down~~.

R802.11.1 Uplift resistance. <u>A continuous uplift load path shall be provided to transfer uplift forces from the roof assembly to the foundation.</u> Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1.2 and R802.11.1.3. <u>Where required for roof or wall assemblies, uplift connection methods shall comply with Section R802.11.1.4.</u>

<u>Exceptions:</u>

<u>1.</u> Where the uplift force does not exceed 200 pounds, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

<u>2.</u> Where the basic wind speed does not exceed 90 mph, the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

<u>**R802.11.1.4 Uplift load path connection methods.** One of the following methods shall be used to provide an continuous uplift load path:</u>

1. <u>Fastening in accordance with Table R602.3(1) subject to the limitations of Section R602.3.5, Item 1, and Section R802.11.1, Exceptions 1 and 2.</u>
2. <u>Connectors, fasteners, or devices installed in accordance with the manufacturer's approved data and installation instructions and sized with a minimum safety factor of 2 to resist uplift loads determined in accordance with Table R802.11 or accepted engineering practice.</u>

Reason: This proposal clarifies that a continuous uplift load path is needed. It also clarifies and provides direction for acceptable methods of providing uplift resistance.

Cost Impact: The code change proposal will not increase the cost of construction.

RB399-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R802.11-RB-CRANDELL.doc

RB400 – 13
R804

Proponent: Bonnie Manley, P.E., American Iron and Steel Institute (bmanley@steel.org)

Revise as follows:

SECTION R804 COLD-FORMED STEEL ROOF FRAMING

R804.1 General. Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall be in accordance ~~comply~~ with the requirements of this section.

R804.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist span or truss, less than or equal to three stories above *grade* plane and with roof slopes not less than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to sites ~~subjected to a maximum~~ where the ultimate design wind speed ~~of 110~~ is less than 139 miles per hour (62~~49~~ m/s), Exposure Category B or C, and ~~a maximum~~ the ground snow load is less than or equal to~~of~~ 70 pounds per square foot (3350 Pa).

R804.2 Structural framing. Load-bearing, cold-formed steel roof framing members shall be in accordance ~~comply~~ with this section. ~~Figure R804.2(1) and with the dimensional and minimum thickness requirements specified in Tables R804.2(1) and R804.2(2). Tracks shall comply with Figure R804.2(2) and shall have a minimum flange width of $1^{1}/_{4}$ inches (32 mm).~~

R804.2.1 Material. Load-bearing, cold-formed steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of ~~one of the following:~~

~~1. ASTM A 653: Grades 33 and 50 (Class 1 and 3).~~
~~2. ASTM A 792: Grades 33 and 50A.~~
~~3.~~ ASTM A 1003,~~:~~ Structural Grades 33 Type H and 50 Type H.

R804.2.2 Corrosion protection. Load-bearing, cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.

R804.2.3 Dimension, thickness and material grade. Load-bearing, cold-formed steel roof framing members shall comply with Figure R804.2.3(1) and with the dimensional and thickness requirements specified in Table R804.2.3. Additionally, all c-shaped sections shall have a minimum flange width of 1.625 inches (41 mm) and a maximum flange width of 2 inches (51 mm). The minimum lip size for c-shaped sections shall be 0.5 inches (13 mm). Tracks shall comply with Figure R804.2.3(2) and shall have a minimum flange width of $1^{1}/_{4}$ inches (32 mm). Minimum Grade 33 ksi steel shall be used wherever 33 mil and 43 mil thicknesses are specified. Minimum Grade 50 ksi steel shall be used wherever 54 and 68 mil thicknesses are specified.

R804.2.4 Identification. Load-bearing, cold-formed steel framing members shall have a legible *label,* stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.

4. Minimum yield strength, in kips per square inch (ksi) (MPa).

~~**R804.2.3 Corrosion protection.** Load-bearing, cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:~~

~~1. A minimum of G 60 in accordance with ASTM A 653.~~
~~2. A minimum of AZ 50 in accordance with ASTM A 792.~~

FIGURE R804.2.3(1) C-SHAPED SECTION

(No change to Figure)

FIGURE R804.2.3(2) TRACK SECTION

(No change to Figure)

~~**TABLE R804.2(1)**~~
~~**LOAD-BEARING COLD-FORMED STEEL MEMBER SIZES**~~

~~NOMINAL MEMBER SIZE MEMBER DESIGNATION[a]~~	~~WEB DEPTH (inches)~~	~~MINIMUM FLANGE WIDTH (inches)~~	~~MAXIMUM FLANGE WIDTH (inches)~~	~~MINIMUM LIP SIZE (inches)~~
~~350S162-t~~	~~3.5~~	~~1.625~~	~~2~~	~~0.5~~
~~550S162-t~~	~~5.5~~	~~1.625~~	~~2~~	~~0.5~~
~~800S162-t~~	~~8~~	~~1.625~~	~~2~~	~~0.5~~
~~1000S162-t~~	~~10~~	~~1.625~~	~~2~~	~~0.5~~
~~1200S162-t~~	~~12~~	~~1.625~~	~~2~~	~~0.5~~

~~For SI: 1 inch = 25.4 mm~~

~~a. The member designation is defined by the first number representing the member depth in hundredths of an inch, the letter "s" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils [see Tble R804.2(2)].~~

~~**TABLE R804.2(2)**~~
~~**MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS**~~

~~DESIGNATION THICKNESS (mils)~~	~~MINIMUM BASE STEEL THICKNESS (inch)~~
~~33~~	~~0.0329~~
~~43~~	~~0.0428~~
~~54~~	~~0.0538~~
~~68~~	~~0.0677~~
~~97~~	~~0.0966~~

~~For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.~~

TABLE R804.2.3 LOAD-BEARING COLD-FORMED STEEL ROOF FRAMING MEMBER SIZES AND THICKNESSES

MEMBER DESIGNATION[a]	**WEB DEPTH (inches)**	**MINIMUM BASE STEEL THICKNESS mil (inches)**
350S162-t	3.5	33 (0.0329), 43 (0.0428), 54 (0.0538)
550S162-t	5.5	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)

800S162-t	8	33 (0.0329), 43 (0.0428), 54 (0.0538), 68 (0.0677)
1000S162-t	10	43 (0.0428), 54 (0.0538), 68 (0.0677)
1200S162-t	12	43 (0.0428), 54 (0.0538), 68 (0.0677)

For SI: 1 inch = 25.4 mm

a. The member designation is defined by the first number representing the member depth in hundredths of an inch, the letter "s" representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils.

~~R804.2.4~~ R804.2.5 Fastening ~~requirements.~~ Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $^1/_2$ inch (13 mm), shall be self-drilling tapping, and shall conform to ASTM C 1513. Structural sheathing shall be attached to cold-formed steel roof rafters with minimum No. 8 self-drilling tapping screws that conform to ASTM C 1513. Screws for attaching structural sheathing to cold-formed steel roof framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $^3/_8$ inch (10 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C 954 or ASTM C 1513 with a bugle-head style and shall be installed in accordance with Section R805. For all connections, screws shall extend through the steel a minimum of three exposed threads. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.
~~Where No. 8 screws are specified in a steel-to-steel connection, reduction of the required number of screws in the connection is permitted in accordance with the reduction factors in Table R804.2.4 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84 mm). When applying the reduction factor, the resulting number of screws shall be rounded up.~~

~~TABLE R804.2.4~~
~~SCREW SUBSTITUTION FACTOR~~

~~SCREW SIZE~~	~~THINNEST CONNECTED STEEL SHEET (mils)~~	
	~~33~~	~~43~~
~~#8~~	~~1.0~~	~~0.67~~
~~#10~~	~~0.93~~	~~0.62~~
~~#12~~	~~0.86~~	~~0.56~~

~~For SI:1 mil = 0.0254 mm.~~

~~R804.2.5~~ R804.2.6 Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing, and web hole patching shall be in accordance with this section.

~~R804.2.5.1~~ R804.2.6.1 Web holes. Web holes in roof framing members shall comply with all of the following conditions:

1. Holes shall conform to Figure ~~R804.2.5.1~~ R804.2.6.1;
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Center-to-center spacing of holes shall not be less than 24 inches (610 mm);
4. The web hole width shall not be greater than one-half the member depth, or $2^1/_2$ inches (64.5 mm);
5. Holes shall have a web hole length not exceeding $4^1/_2$ inches (114 mm); and
6. The minimum distance between the edge of the bearing surface and the edge of the web hole shall not be less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section ~~R804.2.5.2~~ R804.2.6.2, patched in accordance with Section ~~R804.2.5.3~~ R804.2.6.3 or designed in accordance with accepted engineering practices.

FIGURE ~~R804.2.5.1~~ R804.2.6.1 ROOF FRAMING MEMBER WEB HOLES

(No change to Figure)

~~R804.2.5.2~~ R804.2.6.2 Web hole reinforcing. Reinforcement of web holes in ceiling joists not conforming to the requirements of Section ~~R804.2.5.1~~ R804.2.6.1 shall be permitted if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shape section with a hole that does not exceed the web hole size limitations of Section ~~R804.2.5.1~~ R804.2.6.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel reinforcing shall be fastened to the web of the receiving member with No. 8 screws spaced no greater than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (13 mm).

~~R804.2.5.3~~ R804.2.6.3 Hole patching. Patching of web holes in roof framing members not conforming to the requirements in Section ~~R804.2.5.1~~ R804.2.6.1 shall be permitted in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practices where web holes exceed the following size limits:
   1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or
   1.2. The length of the hole measured along the web, exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section ~~R804.2.5.3~~ R804.2.6.3, Item 1, shall be patched with a solid steel plate, stud section or track section in accordance with Figure ~~R804.2.5.3~~ R804.2.6.3. The steel patch shall, as a minimum, be of the same thickness as the receiving member and shall extend at least 1 inch (25 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No.8 screws spaced no greater than 1 inch (25 mm) center-to-center along the edges of the patch with minimum edge distance of $^1/_2$ inch (13 mm).

FIGURE ~~R804.2.5.3~~ R804.2.6.3 ROOF FRAMING MEMBER WEB HOLE PATCH

(No change to Figure)

R804.3 Roof construction. Cold-formed steel roof systems constructed in accordance with the provisions of this section shall consist of both ceiling joists and rafters in accordance with Figure R804.3 and fastened in accordance with Table R804.3~~, and hip framing in accordance with Section R804.3.3~~.

R804.3.1 Ceiling joists. Cold-formed steel ceiling joists shall be in accordance with this section.

R804.3.1.1 Minimum ceiling joist size. Ceiling joist size and thickness shall be determined in accordance with the limits set forth in Tables R804.3.1.1(1) ~~through~~ and ~~R804.3.1.1(8).~~ R804.3.1.1(2). When determining the size of ceiling joists, the lateral support of the top flange shall be classified as unbraced, braced at mid-span or braced at third points in accordance with Section R804.3.1.4. Where sheathing material is attached to the top flange of ceiling joists or where the bracing is spaced closer than third point of the joists, the "third point" values from Tables R804.3.1.1(1) ~~through~~ and ~~R804.3.1.1(8)~~ R804.3.1.1(2) shall be used.

Ceiling joists shall have a bearing support length of not less than $1^1/_2$ inches (38 mm) and shall be connected to roof rafters (heel joint) with No. 10 screws in accordance with Figure~~s~~ R804.3.1.1~~(1) and R804.3.1.1(2)~~ and Table ~~804.3.1.1(9).~~ 804.3.1.1(3).

When continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed the applicable spans in Tables ~~R804.3.1.1(2), R804.3.1.1(4), R804.3.1.1(6) and R804.3.1.1(8).~~ R804.3.1.1(1) and R804.3.1.1(2)

When the *attic* is to be used as an *occupied space,* the ceiling joists shall be designed in accordance with Section R505.

FIGURE R804.3 COLD-FORMED STEEL ROOF CONSTRUCTION

(No change to Figure)

TABLE R804.3
ROOF FRAMING FASTENING SCHEDULE[a,~~b~~]

<table>
<tr><th colspan="3">DESCRIPTION OF BUILDING ELEMENTS</th><th colspan="4">NUMBER AND SIZE OF FASTENERS[a]</th><th>SPACING OF FASTENERS</th></tr>
<tr><td colspan="3">~~Ceiling joist to top track of load-bearing wall~~</td><td colspan="4">~~2 No. 10 screws~~</td><td>~~Each joist~~</td></tr>
<tr><td colspan="3">Roof sheathing (oriented strand board or plywood) to rafter</td><td colspan="4">No. 8 screws</td><td>6" o.c. on edges and 12" o.c. at interior supports. 6" o.c. at gable end truss</td></tr>
<tr><td colspan="3">~~Truss to bearing wall[a]~~</td><td colspan="4">~~2 No. 10 screws~~</td><td>~~Each truss~~</td></tr>
<tr><td colspan="3">Gable end truss to end wall top track</td><td colspan="4">No. 10 screws</td><td>12" o.c.</td></tr>
<tr><td colspan="3">Rafter to ceiling joist</td><td colspan="4">Minimum No. 10 screws, per Table R804.3.1.1(3~~9~~)</td><td>Evenly spaced, not less than $^1/_2$" from all edges.</td></tr>
<tr><td rowspan="12">Ceiling joist or roof truss to top track of bearing wall[b]</td><td rowspan="2">Ceiling Joist Spacing (in.)</td><td rowspan="2">Roof Span (ft)</td><td colspan="4">Ultimate Design Wind Speed (mph) and Exposure Category</td><td rowspan="12">Each ceiling joist or roof truss</td></tr>
<tr><td>126 B
110 C</td><td><139 B
115 C</td><td>126 C</td><td><139 C</td></tr>
<tr><td rowspan="5">16</td><td>24</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>28</td><td>2</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>32</td><td>2</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>36</td><td>2</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>40</td><td>2</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td rowspan="5">24</td><td>24</td><td>2</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>28</td><td>2</td><td>2</td><td>4</td><td>5</td></tr>
<tr><td>32</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>36</td><td>2</td><td>3</td><td>4</td><td>6</td></tr>
<tr><td>40</td><td>2</td><td>3</td><td>5</td><td>6</td></tr>
</table>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.

a. Screws are a minimum No. 10 unless noted otherwise.

b. Indicated number of s~~S~~crews shall be applied through the flanges of the truss or ceiling joist or through each leg of a 54 mil clip angle~~ shall be used with two No. 10 screws in each leg~~. See Section R804.3.8~~9~~ for additional requirements to resist uplift forces.

~~b. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof sheathing panel edges perpendicular to the framing members shall not be required except at the intersection of adjacent roof planes. Roof perimeter shall be supported by framing members or cold-formed blocking of the same depth and gage as the floor members.~~

~~**TABLE R804.3.1.1(1)**~~
~~**CEILING JOIST SPANS**~~
~~**SINGLE SPANS WITH BEARING STIFFENERS**~~
~~**10 lb per sq ft LIVE LOAD (NO ATTIC STORAGE)[a, b, c] 33 ksi STEEL**~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~9'-5"~~	~~8'-6"~~	~~12'-2"~~	~~10'-4"~~	~~12'-2"~~	~~10'-7"~~
~~350S162-43~~	~~10'-3"~~	~~9'-2"~~	~~12'-10"~~	~~11'-2"~~	~~12'-10"~~	~~11'-2"~~
~~350S162-54~~	~~11'-1"~~	~~9'-11"~~	~~13'-9"~~	~~12'-0"~~	~~13'-9"~~	~~12'-0"~~
~~350S162-68~~	~~12'-1"~~	~~10'-9"~~	~~14'-8"~~	~~12'-10"~~	~~14'-8"~~	~~12'-10"~~
~~350S162-97~~	~~14'-4"~~	~~12'-7"~~	~~16'-4"~~	~~14'-3"~~	~~16'-4"~~	~~14'-3"~~
~~550S162-33~~	~~10'-7"~~	~~9'-6"~~	~~14'-10"~~	~~12'-10"~~	~~15'-11"~~	~~13'-4"~~
~~550S162-43~~	~~11'-8"~~	~~10'-6"~~	~~16'-4"~~	~~14'-3"~~	~~17'-10"~~	~~15'-3"~~
~~550S162-54~~	~~12'-6"~~	~~11'-2"~~	~~17'-7"~~	~~15'-7"~~	~~19'-5"~~	~~16'-10"~~
~~550S162-68~~	~~13'-6"~~	~~12'-1"~~	~~19'-2"~~	~~17'-1"~~	~~21'-0"~~	~~18'-4"~~
~~550S162-97~~	~~15'-9"~~	~~13'-11"~~	~~21'-8"~~	~~19'-3"~~	~~23'-5"~~	~~20'-5"~~
~~800S162-33~~	~~12'-2"~~	~~10'-11"~~	~~17'-8"~~	~~15'-10"~~	~~19'-10"~~	~~17'-1"~~
~~800S162-43~~	~~13'-0"~~	~~11'-9"~~	~~18'-10"~~	~~17'-0"~~	~~21'-6"~~	~~19'-1"~~
~~800S162-54~~	~~13'-10"~~	~~12'-5"~~	~~20'-0"~~	~~18'-0"~~	~~22'-9"~~	~~20'-4"~~
~~800S162-68~~	~~14'-11"~~	~~13'-4"~~	~~21'-3"~~	~~19'-1"~~	~~24'-1"~~	~~21'-8"~~
~~800S162-97~~	~~17'-1"~~	~~15'-2"~~	~~23'-10"~~	~~21'-3"~~	~~26'-7"~~	~~23'-10"~~
~~1000S162-43~~	~~13'-11"~~	~~12'-6"~~	~~20'-2"~~	~~18'-3"~~	~~23'-1"~~	~~20'-9"~~
~~1000S162-54~~	~~14'-9"~~	~~13'-3"~~	~~21'-4"~~	~~19'-3"~~	~~24'-4"~~	~~22'-0"~~
~~1000S162-68~~	~~15'-10"~~	~~14'-2"~~	~~22'-8"~~	~~20'-5"~~	~~25'-9"~~	~~23'-2"~~
~~1000S162-97~~	~~18'-0"~~	~~16'-0"~~	~~25'-3"~~	~~22'-7"~~	~~28'-3"~~	~~25'-4"~~
~~1200S162-43~~	~~14'-8"~~	~~13'-3"~~	~~21'-4"~~	~~19'-3"~~	~~24'-5"~~	~~21'-8"~~
~~1200S162-54~~	~~15'-7"~~	~~14'-0"~~	~~22'-6"~~	~~20'-4"~~	~~25'-9"~~	~~23'-2"~~
~~1200S162-68~~	~~16'-8"~~	~~14'-11"~~	~~23'-11"~~	~~21'-6"~~	~~27'-2"~~	~~24'-6"~~
~~1000S162-97~~	~~18'-9"~~	~~16'-9"~~	~~26'-6"~~	~~23'-8"~~	~~29'-9"~~	~~26'-9"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criterion: *L*/240 for total loads.~~
~~b. Ceiling deal load = 5 psf.~~
~~c. Bearing stiffners are required at all bearing points and concentrated load locations.~~

~~**TABLE R804.3.1.1(2)**~~
~~**CEILING JOIST SPANS**~~
~~**TWO EQUAL SPANS WITH BEARING STIFFENERS**~~
~~**10 lb per sq ft LIVE LOAD (NO ATTIC STORAGE)[a, b, c] 33 ksi STEEL**~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~12'-11"~~	~~10'-11"~~	~~13'-5"~~	~~10'-11"~~	~~13'-5"~~	~~10'-11"~~
~~350S162-43~~	~~14'-2"~~	~~12'-8"~~	~~15'-10"~~	~~12'-11"~~	~~15'-10"~~	~~12'-11"~~
~~350S162-54~~	~~15'-6"~~	~~13'-10"~~	~~17'-1"~~	~~14'-6"~~	~~17'-9"~~	~~14'-6"~~
~~350S162-68~~	~~17'-3"~~	~~15'-3"~~	~~18'-6"~~	~~16'-1"~~	~~19'-8"~~	~~16'-1"~~
~~350S162-97~~	~~20'-10"~~	~~18'-4"~~	~~21'-5"~~	~~18'-10"~~	~~21'-11"~~	~~18'-10"~~
~~550S162-33~~	~~14'-4"~~	~~12'-11"~~	~~16'-7"~~	~~14'-1"~~	~~17'-3"~~	~~14'-1"~~
~~550S162-43~~	~~16'-0"~~	~~14'-1"~~	~~17'-11"~~	~~16'-1"~~	~~20'-7"~~	~~16'-10"~~
~~550S162-54~~	~~17'-4"~~	~~15'-6"~~	~~19'-5"~~	~~17'-6"~~	~~23'-2"~~	~~19'-0"~~
~~550S162-68~~	~~19'-1"~~	~~16'-11"~~	~~20'-10"~~	~~18'-8"~~	~~25'-2"~~	~~21'-5"~~
~~550S162-97~~	~~22'-8"~~	~~19'-9"~~	~~23'-6"~~	~~20'-11"~~	~~27'-11"~~	~~25'-1"~~
~~800S162-33~~	~~16'-5"~~	~~14'-10"~~	~~19'-2"~~	~~17'-3"~~	~~23'-1"~~	~~18'-3"~~
~~800S162-43~~	~~17'-9"~~	~~15'-11"~~	~~20'-6"~~	~~18'-5"~~	~~25'-0"~~	~~22'-6"~~
~~800S162-54~~	~~19'-1"~~	~~17'-1"~~	~~21'-8"~~	~~19'-6"~~	~~26'-4"~~	~~23'-9"~~
~~800S162-68~~	~~20'-9"~~	~~18'-6"~~	~~23'-1"~~	~~20'-9"~~	~~28'-0"~~	~~25'-2"~~
~~800S162-97~~	~~24'-5"~~	~~21'-6"~~	~~26'-0"~~	~~23'-2"~~	~~31'-1"~~	~~27'-9"~~
~~1000S162-43~~	~~18'-11"~~	~~17'-0"~~	~~21'-11"~~	~~19'-9"~~	~~26'-8"~~	~~24'-1"~~
~~1000S162-54~~	~~20'-3"~~	~~18'-2"~~	~~23'-2"~~	~~20'-10"~~	~~28'-2"~~	~~25'-5"~~
~~1000S162-68~~	~~21'-11"~~	~~19'-7"~~	~~24'-7"~~	~~22'-2"~~	~~29'-10"~~	~~26'-11"~~
~~1000S162-97~~	~~25'-7"~~	~~22'-7"~~	~~27'-6"~~	~~24'-6"~~	~~33'-0"~~	~~29'-7"~~
~~1200S162-43~~	~~19'-11"~~	~~17'-11"~~	~~23'-1"~~	~~20'-10"~~	~~28'-3"~~	~~25'-6"~~
~~1200S162-54~~	~~21'-3"~~	~~19'-1"~~	~~24'-5"~~	~~22'-0"~~	~~29'-9"~~	~~26'-10"~~
~~1200S162-68~~	~~23'-0"~~	~~20'-7"~~	~~25'-11"~~	~~23'-4"~~	~~31'-6"~~	~~28'-4"~~
~~1000S162-97~~	~~26'-7"~~	~~23'-6"~~	~~28'-9"~~	~~25'-10"~~	~~34'-8"~~	~~31'-1"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criterion: *L*/240 for total loads.~~
~~b. Ceiling deal load = 5 psf.~~
~~c. Bearing stiffners are required at all bearing points and concentrated load locations.~~

~~TABLE R804.3.1.1(3)~~
~~CEILING JOIST SPANS~~
~~SINGLE SPANS WITH BEARING STIFFENERS~~
~~20 lb per sq ft LIVE LOAD (LIMITED ATTIC STORAGE)[a, b, c] 33 ksi STEEL~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~8'-2"~~	~~7'-2"~~	~~9'-9"~~	~~8'-1"~~	~~9'-11"~~	~~8'-1"~~
~~350S162-43~~	~~8'-10"~~	~~7'-10"~~	~~11'-0"~~	~~9'-5"~~	~~11'-0"~~	~~9'-7"~~
~~350S162-54~~	~~9'-6"~~	~~8'-6"~~	~~11'-9"~~	~~10'-3"~~	~~11'-9"~~	~~10'-3"~~
~~350S162-68~~	~~10'-4"~~	~~9'-2"~~	~~12'-7"~~	~~11'-0"~~	~~12'-7"~~	~~11'-0"~~
~~350S162-97~~	~~12'-1"~~	~~10'-8"~~	~~14'-0"~~	~~12'-0"~~	~~14'-0"~~	~~12'-0"~~
~~550S162-33~~	~~9'-2"~~	~~8'-3"~~	~~12'-2"~~	~~10'-2"~~	~~12'-6"~~	~~10'-5"~~
~~550S162-43~~	~~10'-1"~~	~~9'-1"~~	~~13'-7"~~	~~11'-7"~~	~~14'-5"~~	~~12'-2"~~
~~550S162-54~~	~~10'-9"~~	~~9'-8"~~	~~14'-10"~~	~~12'-10"~~	~~15'-11"~~	~~13'-6"~~
~~550S162-68~~	~~11'-7"~~	~~10'-4"~~	~~16'-4"~~	~~14'-0"~~	~~17'-5"~~	~~14'-11"~~
~~550S162-97~~	~~13'-4"~~	~~11'-10"~~	~~18'-5"~~	~~16'-2"~~	~~20'-1"~~	~~17'-1"~~
~~800S162-33~~	~~10'-7"~~	~~9'-6"~~	~~15'-1"~~	~~13'-0"~~	~~16'-2"~~	~~13'-7"~~
~~800S162-43~~	~~11'-4"~~	~~10'-2"~~	~~16'-5"~~	~~14'-6"~~	~~18'-2"~~	~~15'-9"~~
~~800S162-54~~	~~12'-0"~~	~~10'-9"~~	~~17'-4"~~	~~15'-6"~~	~~19'-6"~~	~~17'-0"~~
~~800S162-68~~	~~12'-10"~~	~~11'-6"~~	~~18'-5"~~	~~16'-6"~~	~~20'-10"~~	~~18'-3"~~
~~800S162-97~~	~~14'-7"~~	~~12'-11"~~	~~20'-5"~~	~~18'-3"~~	~~22'-11"~~	~~20'-5"~~
~~1000S162-43~~	~~12'-1"~~	~~10'-11"~~	~~17'-7"~~	~~15'-10"~~	~~19'-11"~~	~~17'-3"~~
~~1000S162-54~~	~~12'-10"~~	~~11'-6"~~	~~18'-7"~~	~~16'-9"~~	~~21'-2"~~	~~18'-10"~~
~~1000S162-68~~	~~13'-8"~~	~~12'-3"~~	~~19'-8"~~	~~17'-8"~~	~~22'-4"~~	~~20'-1"~~
~~1000S162-97~~	~~15'-4"~~	~~13'-8"~~	~~21'-8"~~	~~19'-5"~~	~~24'-5"~~	~~21'-11"~~
~~1200S162-43~~	~~12'-9"~~	~~11'-6"~~	~~18'-7"~~	~~16'-6"~~	~~20'-9"~~	~~18'-2"~~
~~1200S162-54~~	~~13'-6"~~	~~12'-2"~~	~~19'-7"~~	~~17'-8"~~	~~22'-5"~~	~~20'-2"~~
~~1200S162-68~~	~~14'-4"~~	~~12'-11"~~	~~20'-9"~~	~~18'-8"~~	~~23'-7"~~	~~21'-3"~~
~~1000S162-97~~	~~16'-1"~~	~~14'-4"~~	~~22'-10"~~	~~20'-6"~~	~~25'-9"~~	~~23'-2"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criterion: *L*/240 for total loads.~~
~~b. Ceiling deal load = 5 psf.~~
~~c. Bearing stiffners are required at all bearing points and concentrated load locations.~~

~~TABLE R804.3.1.1(4)~~
~~CEILING JOIST SPANS~~
~~TWO EQUAL SPANS WITH BEARING STIFFENERS~~
~~20 lb per sq ft LIVE LOAD (LIMITED ATTIC STORAGE)[a, b, c] 33 ksi STEEL~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~10'-2"~~	~~8'-4"~~	~~10'-2"~~	~~8'-4"~~	~~10'-2"~~	~~8'-4"~~
~~350S162-43~~	~~12'-1"~~	~~9'-10"~~	~~12'-1"~~	~~9'-10"~~	~~12'-1"~~	~~9'-10"~~
~~350S162-54~~	~~13'-3"~~	~~11'-0"~~	~~13'-6"~~	~~11'-0"~~	~~13'-6"~~	~~11'-0"~~
~~350S162-68~~	~~14'-7"~~	~~12'-3"~~	~~15'-0"~~	~~12'-3"~~	~~15'-0"~~	~~12'-3"~~
~~350S162-97~~	~~17'-6"~~	~~14'-3"~~	~~17'-6"~~	~~14'-3"~~	~~17'-6"~~	~~14'-3"~~
~~550S162-33~~	~~12'-5"~~	~~10'-9"~~	~~13'-2"~~	~~10'-9"~~	~~13'-2"~~	~~10'-9"~~
~~550S162-43~~	~~13'-7"~~	~~12'-1"~~	~~15'-6"~~	~~12'-9"~~	~~15'-8"~~	~~12'-9"~~
~~550S162-54~~	~~14'-11"~~	~~13'-4"~~	~~16'-10"~~	~~14'-5"~~	~~17'-9"~~	~~14'-5"~~
~~550S162-68~~	~~16'-3"~~	~~14'-5"~~	~~18'-0"~~	~~16'-1"~~	~~20'-0"~~	~~16'-4"~~
~~550S162-97~~	~~19'-1"~~	~~16'-10"~~	~~20'-3"~~	~~18'-0"~~	~~23'-10"~~	~~19'-5"~~
~~800S162-33~~	~~14'-3"~~	~~12'-4"~~	~~16'-7"~~	~~12'-4"~~	~~16'-7"~~	~~12'-4"~~
~~800S162-43~~	~~15'-4"~~	~~13'-10"~~	~~17'-9"~~	~~16'-0"~~	~~21'-8"~~	~~17'-9"~~
~~800S162-54~~	~~16'-5"~~	~~14'-9"~~	~~18'-10"~~	~~16'-11"~~	~~22'-11"~~	~~20'-6"~~
~~800S162-68~~	~~17'-9"~~	~~15'-11"~~	~~20'-0"~~	~~18'-0"~~	~~24'-3"~~	~~21'-10"~~
~~800S162-97~~	~~20'-8"~~	~~18'-3"~~	~~22'-3"~~	~~19'-11"~~	~~26'-9"~~	~~24'-0"~~
~~1000S162-43~~	~~16'-5"~~	~~14'-9"~~	~~19'-0"~~	~~17'-2"~~	~~23'-3"~~	~~18'-11"~~
~~1000S162-54~~	~~17'-6"~~	~~15'-8"~~	~~20'-1"~~	~~18'-1"~~	~~24'-6"~~	~~22'-1"~~
~~1000S162-68~~	~~18'-10"~~	~~16'-10"~~	~~21'-4"~~	~~19'-2"~~	~~25'-11"~~	~~23'-4"~~
~~1000S162-97~~	~~21'-8"~~	~~19'-3"~~	~~23'-7"~~	~~21'-2"~~	~~28'-5"~~	~~25'-6"~~
~~1200S162-43~~	~~17'-3"~~	~~15'-7"~~	~~20'-1"~~	~~18'-2"~~	~~24'-6"~~	~~18'-3"~~
~~1200S162-54~~	~~18'-5"~~	~~16'-6"~~	~~21'-3"~~	~~19'-2"~~	~~25'-11"~~	~~23'-5"~~
~~1200S162-68~~	~~19'-9"~~	~~17'-8"~~	~~22'-6"~~	~~20'-3"~~	~~27'-4"~~	~~24'-8"~~
~~1000S162-97~~	~~22'-7"~~	~~20'-1"~~	~~24'-10"~~	~~22'-3"~~	~~29'-11"~~	~~26'-11"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

- ~~a. Deflection criterion: *L*/240 for total loads.~~
- ~~b. Ceiling deal load = 5 psf.~~
- ~~c. Bearing stiffners are required at all bearing points and concentrated load locations.~~

TABLE ~~R804.3.1.1(5)~~ R804.3.1.1(1)
CEILING JOIST SPANS
~~SINGLE SPANS WITHOUT BEARING STIFFENERS~~
10 lb per sq ft LIVE LOAD (NO ATTIC STORAGE)[a, b, c]
~~33 ksi STEEL~~

MEMBER DESIGNATION	ALLOWABLE SPAN (feet-inches)					
	Lateral Support of Top (Compression) Flange					
	Unbraced		Mid-Span Bracing		Third-Point Bracing	
	Ceiling Joist Spacing (inches)					
	16	24	16	24	16	24
350S162-33	9'-5"	8'-6"	12'-2"	10'-4"	12'-2"	10'-7"
350S162-43	10'-3"	9'-12"	13'-2"	11'-6"	13'-2"	11'-6"
350S162-54	11'-1"	9'-11"	13'-9"	12'-0"	13'-9"	12'-0"
350S162-68	12'-1"	10'-9"	14'-8"	12'-10"	14'-8"	12'-10"
~~350S162-97~~	~~14'-4"~~	~~12'-7"~~	~~16'-10"~~	~~14'-3"~~	~~16'-4"~~	~~14'-3"~~
550S162-33	10'-7"	9'-6"	14'-10"	12'-10"	15'-11"	13'-4"
550S162-43	11'-8"	10'-6"	16'-4"	14'-3"	17'-10"	15'-3"
550S162-54	12'-6"	11'-2"	17'-7"	15'-7"	19'-5"	16'-10"
550S162-68	13'-6"	12'-1"	19'-2"	17'-0"	21'-0"	18'-4"
~~550S162-97~~	~~15'-9"~~	~~13'-11"~~	~~21'-8"~~	~~19'-3"~~	~~23'-5"~~	~~20'-5"~~
800S162-33	—	—	—	—	—	—
800S162-43	13'-0"	11'-9"	18'-10"	17'-0"	21'-6"	19'-0"
800S162-54	13'-10"	12'-5"	20'-0"	18'-0"	22'-9"	20'-4"
800S162-68	14'-11"	13'-4"	21'-3"	19'-1"	24'-1"	21'-8"
~~800S162-97~~	~~17'-1"~~	~~15'-2"~~	~~23'-10"~~	~~21'-3"~~	~~26'-7"~~	~~23'-10"~~
1000S162-43	—	—	—	—	—	—
1000S162-54	14'-9"	13'-3"	21'-4"	19'-3"	24'-4"	22'-0"
1000S162-68	15'-10"	14'-2"	22'-8"	20'-5"	25'-9"	23'-2"
~~1000S162-97~~	~~18'-0"~~	~~16'-0"~~	~~25'-3"~~	~~22'-7"~~	~~28'-3"~~	~~25'-4"~~
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	16'-8"	14'-11"	23'-11"	21'-6"	27'-2"	24'-6"
~~1000S162-97~~	~~18'-9"~~	~~16'-9"~~	~~26'-6"~~	~~23'-8"~~	~~29'-9"~~	~~26'-9"~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criterion: *L*/240 for total loads.
b. Ceiling deal load = 5 psf.
c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R804.3.1.1(6)~~
~~CEILING JOIST SPANS~~
~~TWO EQUAL SPANS WITHOUT BEARING STIFFENERS~~
~~10 lb per sq ft LIVE LOAD (NO ATTIC STORAGE)~~[a,b] ~~33 ksi STEEL~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~11'-9"~~	~~8'-11"~~	~~11'-9"~~	~~8'-11"~~	~~11'-9"~~	~~8'-11"~~
~~350S162-43~~	~~14'-2"~~	~~11'-7"~~	~~14'-11"~~	~~11'-7"~~	~~14'-11"~~	~~11'-7"~~
~~350S162-54~~	~~15'-6"~~	~~13'-10"~~	~~17'-1"~~	~~13'-10"~~	~~17'-7"~~	~~13'-10"~~
~~350S162-68~~	~~17'-3"~~	~~15'-3"~~	~~18'-6"~~	~~16'-1"~~	~~19'-8"~~	~~16'-1"~~
~~350S162-97~~	~~20'-10"~~	~~18'-4"~~	~~21'-5"~~	~~18'-9"~~	~~21'-11"~~	~~18'-9"~~
~~550S162-33~~	~~13'-4"~~	~~9'-11"~~	~~13'-4"~~	~~9'-11"~~	~~13'-4"~~	~~9'-11"~~
~~550S162-43~~	~~16'-0"~~	~~13'-6"~~	~~17'-9"~~	~~13'-6"~~	~~17'-9"~~	~~13'-6"~~
~~550S162-54~~	~~17'-4"~~	~~15'-6"~~	~~19'-5"~~	~~16'-10"~~	~~21'-9"~~	~~16'-10"~~
~~550S162-68~~	~~19'-1"~~	~~16'-11"~~	~~20'-10"~~	~~18'-8"~~	~~24'-11"~~	~~20'-6"~~
~~550S162-97~~	~~22'-8"~~	~~20'-0"~~	~~23'-9"~~	~~21'-1"~~	~~28'-2"~~	~~25'-1"~~
~~800S162-33~~	—	—	—	—	—	—
~~800S162-43~~	~~17'-9"~~	~~15'-7"~~	~~20'-6"~~	~~15'-7"~~	~~21'-0"~~	~~15'-7"~~
~~800S162-54~~	~~19'-1"~~	~~17'-1"~~	~~21'-8"~~	~~19'-6"~~	~~26'-4"~~	~~23'-10"~~
~~800S162-68~~	~~20'-9"~~	~~18'-6"~~	~~23'-1"~~	~~20'-9"~~	~~28'-0"~~	~~25'-2"~~
~~800S162-97~~	~~24'-5"~~	~~21'-6"~~	~~26'-0"~~	~~23'-2"~~	~~31'-1"~~	~~27'-9"~~
~~1000S162-43~~	—	—	—	—	—	—
~~1000S162-54~~	~~20'-3"~~	~~18'-2"~~	~~23'-2"~~	~~20'-10"~~	~~28'-2"~~	~~21'-2"~~
~~1000S162-68~~	~~21'-11"~~	~~19'-7"~~	~~24'-7"~~	~~22'-2"~~	~~29'-10"~~	~~26'-11"~~
~~1000S162-97~~	~~25'-7"~~	~~22'-7"~~	~~27'-6"~~	~~24'-6"~~	~~33'-0"~~	~~29'-7"~~
~~1200S162-43~~	—	—	—	—	—	—
~~1200S162-54~~	—	—	—	—	—	—
~~1200S162-68~~	~~23'-0"~~	~~20'-7"~~	~~25'-11"~~	~~23'-4"~~	~~31'-6"~~	~~28'-4"~~
~~1000S162-97~~	~~26'-7"~~	~~23'-6"~~	~~28'-9"~~	~~25'-10"~~	~~34'-8"~~	~~31'-1"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criterion: *L*/240 for total loads.~~
~~b. Ceiling deal load = 5 psf.~~

TABLE ~~R804.3.1.1(7)~~ R804.3.1.1(2)
CEILING JOIST SPANS
~~SINGLE SPANS WITHOUT BEARING STIFFENERS~~
20 lb per sq ft LIVE LOAD (LIMITED ATTIC STORAGE)[a, b, c]
~~33 ksi STEEL~~

MEMBER DESIGNATION	ALLOWABLE SPAN (feet-inches)					
	Lateral Support of Top (Compression) Flange					
	Unbraced		Mid-Span Bracing		Third-Point Bracing	
	Ceiling Joist Spacing (inches)					
	16	24	16	24	16	24
350S162-33	8'-2"	6'-10"	9'-9"	6'-10"	9'-11"	6'-10"
350S162-43	8'-10"	7'-10"	11'-0"	9'-5"	11'-0"	9'-7"
350S162-54	9'-6"	8'-6"	11'-9"	10'-3"	11'-9"	10'-3"
350S162-68	10'-4"	9'-2"	12'-7"	11'-0"	12'-7"	11'-0"
~~350S162-97~~	~~12'-10"~~	~~10'-8"~~	~~13'-9"~~	~~12'-0"~~	~~13'-9"~~	~~12'-0"~~
550S162-33	9'-2"	8'-3"	12'-2"	8'-5"	12'-6"	8'-5"
550S162-43	10'-1"	9'-1"	13'-7"	11'-8"	14'-5"	12'-2"
550S162-54	10'-9"	9'-8"	14'-10"	12'-10"	15'-11"	13'-6"
550S162-68	11'-7"	10'-4"	16'-4"	14'-0"	17'-5"	14'-11"
~~550S162-97~~	~~13'-4"~~	~~11'-10"~~	~~18'-5"~~	~~16'-2"~~	~~20'-1"~~	~~17'-4"~~
800S162-33	—	—	—	—	—	—
800S162-43	11'-4"	10'-1"	16'-5"	13'-6"	18'-1"	13'-6"
800S162-54	20'-0"	10'-9"	17'-4"	15'-6"	19'-6"	27'-0"
800S162-68	12'-10"	11'-6"	18'-5"	16'-6"	20'-10"	18'-3"
~~800S162-97~~	~~14'-7"~~	~~12'-11"~~	~~20'-5"~~	~~18'-3"~~	~~22'-11"~~	~~20'-5"~~
1000S162-43	—	—	—	—	—	—
1000S162-54	12'-10"	11'-6"	18'-7"	16'-9"	21'-2"	15'-5"
1000S162-68	13'-8"	12'-3"	19'-8"	17'-8"	22'-4"	20'-1"
~~1000S162-97~~	~~15'-4"~~	~~13'-8"~~	~~21'-8"~~	~~19'-5"~~	~~24'-5"~~	~~21'-11"~~
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	14'-4"	12'-11"	20'-9"	18'-8"	23'-7"	21'-3"
~~1000S162-97~~	~~16'-1"~~	~~14'-4"~~	~~22'-10"~~	~~20'-6"~~	~~25'-9"~~	~~23'-2"~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criterion: *L*/240 for total loads.
b. Ceiling deal load = 5 psf.
c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~TABLE R804.3.1.1(8)~~
~~CEILING JOIST SPANS~~
~~TWO EQUAL SPANS WITHOUT BEARING STIFFENERS~~
~~20 lb per sq ft LIVE LOAD (LIMITED ATTIC STORAGE)[a, b] 33 ksi STEEL~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN (feet-inches)~~					
	~~Lateral Support of Top (Compression) Flange~~					
	~~Unbraced~~		~~Mid-Span Bracing~~		~~Third-Point Bracing~~	
	~~Ceiling Joist Spacing (inches)~~					
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~350S162-33~~	~~8'-1"~~	~~6'-1"~~	~~8'-1"~~	~~6'-1"~~	~~8'-1"~~	~~6'-1"~~
~~350S162-43~~	~~10'-7"~~	~~8'-1"~~	~~10'-7"~~	~~8'-1"~~	~~10'-7"~~	~~8'-1"~~
~~350S162-54~~	~~12'-8"~~	~~9'-10"~~	~~12'-8"~~	~~9'-10"~~	~~12'-8"~~	~~9'-10"~~
~~350S162-68~~	~~14'-7"~~	~~11'-10"~~	~~14'-11"~~	~~11'-10"~~	~~14'-11"~~	~~11'-10"~~
~~350S162-97~~	~~17'-6"~~	~~14'-3"~~	~~17'-6"~~	~~14'-3"~~	~~17'-6"~~	~~14'-3"~~
~~550S162-33~~	~~8'-11"~~	~~6'-8"~~	~~8'-11"~~	~~6'-8"~~	~~8'-11"~~	~~6'-8"~~
~~550S162-43~~	~~12'-3"~~	~~9'-2"~~	~~12'-3"~~	~~9'-2"~~	~~12'-3"~~	~~9'-2"~~
~~550S162-54~~	~~14'-11"~~	~~11'-8"~~	~~15'-4"~~	~~11'-8"~~	~~15'-4"~~	~~11'-8"~~
~~550S162-68~~	~~16'-3"~~	~~14'-5"~~	~~18'-0"~~	~~15'-8"~~	~~18'-10"~~	~~14'-7"~~
~~550S162-97~~	~~19'-1"~~	~~16'-10"~~	~~20'-3"~~	~~18'-0"~~	~~23'-9"~~	~~19'-5"~~
~~800S162-33~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~
~~800S162-43~~	~~13'-11"~~	~~9'-10"~~	~~13'-11"~~	~~9'-10"~~	~~13'-11"~~	~~9'-10"~~
~~800S162-54~~	~~16'-5"~~	~~13'-9"~~	~~18'-8"~~	~~13'-9"~~	~~18'-8"~~	~~13'-9"~~
~~800S162-68~~	~~17'-9"~~	~~15'-11"~~	~~20'-0"~~	~~18'-0"~~	~~24'-1"~~	~~18'-3"~~
~~800S162-97~~	~~20'-8"~~	~~18'-3"~~	~~22'-3"~~	~~19'-11"~~	~~26'-9"~~	~~24'-0"~~
~~1000S162-43~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~
~~1000S162-54~~	~~17'-6"~~	~~13'-11"~~	~~19'-1"~~	~~13'-11"~~	~~19'-1"~~	~~13'-11"~~
~~1000S162-68~~	~~18'-10"~~	~~16'-10"~~	~~21'-4"~~	~~19'-2"~~	~~25'-11"~~	~~19'-7"~~
~~1000S162-97~~	~~21'-8"~~	~~19'-3"~~	~~23'-7"~~	~~21'-2"~~	~~28'-5"~~	~~25'-6"~~
~~1200S162-43~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~
~~1200S162-54~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~
~~1200S162-68~~	~~19'-9"~~	~~17'-8"~~	~~22'-6"~~	~~19'-8"~~	~~26'-8"~~	~~19'-8"~~
~~1000S162-97~~	~~22'-7"~~	~~20'-1"~~	~~24'-10"~~	~~22'-3"~~	~~29'-11"~~	~~26'-11"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Deflection criterion: *L*/240 for total loads.~~
~~b. Ceiling deal load = 5 psf.~~

TABLE ~~R804.3.1.1(9)~~ R804.3.1.1(3)
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO ROOF RAFTER CONNECTION[a]

ROOF SLOPE	NUMBER OF SCREWS																			
	Building width (feet)																			
	24				28				32				36				40			
	Ground snow load (psf)																			
	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
3/12	5	6	9	11	5	7	10	13	6	8	11	15	7	8	13	17	8	9	14	19
4/12	4	5	7	9	4	5	8	10	5	6	9	12	5	7	10	13	6	7	11	14
5/12	3	4	6	7	4	4	6	8	4	5	7	10	5	5	8	11	5	6	9	12
6/12	3	3	5	6	3	4	6	7	4	4	6	8	4	5	7	9	4	5	8	10
7/12	3	3	4	6	3	3	5	7	3	4	6	7	4	4	6	8	4	5	7	9
8/12	2	3	4	5	3	3	5	6	3	4	5	7	3	4	6	8	4	4	6	8
9/12	2	3	4	5	3	3	4	6	3	3	5	6	3	4	5	7	3	4	6	8
10/12	2	2	4	5	2	3	4	5	3	3	5	6	3	3	5	7	3	4	6	7
11/12	2	2	3	4	2	3	4	5	3	3	4	6	3	3	5	6	3	4	5	7
12/12	2	2	3	4	2	3	4	5	2	3	4	5	3	3	5	6	3	4	5	7

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.
a. Screws shall be No. 10.

FIGURE R804.3.1.1~~(1)~~ JOIST TO RAFTER CONNECTION

(No change to Figure)

~~**R804.3.1.2 Ceiling joist bearing stiffeners.** Where required in Tables R804.3.1.1(1) through R804.3.1.1(8), bearing stiffeners shall be installed at each bearing support in accordance with Figure R804.3.1.1(2). Bearing stiffeners shall be fabricated from a C-shaped or track member in accordance with the one of following:~~

1. ~~C-shaped bearing stiffeners shall be a minimum 33 mils (0.84 mm) thick.~~
2. ~~Track bearing stiffener shall be a minimum 43 mils (1.09 mm) thick.~~

~~The minimum length of a bearing stiffener shall be the depth of member being stiffened minus $^3/_8$ inch (9.5 mm). Each stiffener shall be fastened to the web of the ceiling joist with a minimum of four No. 8 screws equally spaced as shown in Figure R804.3.1.1(2). Installation of stiffeners shall be permitted on either side of the web.~~

~~FIGURE R804.3.1.1(2) BEARING STIFFENER~~

~~R804.3.1.3~~ R804.3.1.2 Ceiling joist bottom flange bracing. The bottom flanges of ceiling joists shall be laterally braced by the application of gypsum board or continuous steel straps installed perpendicular to the joist run in accordance with one of the following:

1. Gypsum board shall be fastened with No. 6 screws in accordance with Section R702.
2. Steel straps with a minimum size of $1^1/_2$ inches by 33 mils (38 mm by 0.84 mm) shall be installed at a maximum spacing of 4 feet (1219 mm). Straps shall be fastened to the bottom flange at each joist with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between joists at a maximum spacing of 12 feet (3658 mm)

measured along a line of continuous strapping (perpendicular to the joist run). Blocking shall also be located at the termination of all straps.

~~R804.3.1.4~~ R804.3.1.3 Ceiling joist top flange bracing. The top flanges of ceiling joists shall be laterally braced as required by Tables R804.3.1.1(1) ~~through~~ and ~~R804.3.1.1(8),~~ R804.3.1.1(2) in accordance with one of the following:

1. Minimum 33-mil (0.84 mm) C-shaped member in accordance with Figure ~~R804.3.1.4(1).~~ R804.3.1.3(1).
2. Minimum 33-mil (0.84 mm) track section in accordance with Figure ~~R804.3.1.4(1).~~ R804.3.1.3(1),
3. Minimum 33-mil (0.84 mm) hat section in accordance with Figure ~~R804.3.1.4(1).~~ R804.3.1.3(1).
4. Minimum 54-mil (1.37 mm) $1^1/_2$-inch cold-rolled channel section in accordance with Figure ~~R804.3.1.4(1).~~ R804.3.1.3(1).
5. Minimum $1^1/_2$-inch by 33-mil (38 mm by 0.84 mm) continuous steel strap in accordance with ~~Figure R804.3.1.4(2).~~ R804.3.1.3(2).

Lateral bracing shall be installed perpendicular to the ceiling joists and shall be fastened to the top flange of each joist with one No. 8 screw. Blocking shall be installed between joists in line with bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists. Ends of lateral bracing shall be attached to blocking or anchored to a stable building component with two No. 8 screws.

~~R804.3.1.5~~ R804.3.1.4 Ceiling joist splicing. Splices in ceiling joists shall be permitted, if ceiling joist splices are supported at interior bearing points and are constructed in accordance with Figure ~~R804.3.1.5~~ R804.3.1.4. The number of screws on each side of the splice shall be the same as required for the heel joint connection in Table ~~R804.3.1.1(9).~~ R804.3.1.1(3).

FIGURE ~~R804.3.1.4(1)~~ R804.3.1.3(1) CEILING JOIST TOP FLANGE BRACING WITH C-SHAPE, TRACK OR COLD-ROLLED CHANNEL

(No change to Figure)

FIGURE ~~R804.3.1.4(2)~~ R804.3.1.3(2) CEILING JOIST TOP FLANGE BRACING WITH CONTINUOUS STEEL STRAP AND BLOCKING

(No change to Figure)

FIGURE ~~R804.3.1.5~~ R804.3.1.4 SPLICED CEILING JOISTS

(No change to Figure)

R804.3.2 Roof rafters. Cold-formed steel roof rafters shall be in accordance with this section.

R804.3.2.1 Minimum roof rafter sizes. Roof rafter size and thickness shall be determined in accordance with the limits set forth in Table~~s~~ R804.3.2.1(1)~~ and R804.3.2.1(2)~~ based on the horizontal projection of the roof rafter span. For determination of roof rafter sizes, reduction of roof spans shall be permitted when a roof rafter support brace is installed in accordance with Section R804.3.2.2. The reduced roof rafter span shall be taken as the larger of the distance from the roof rafter support brace to the ridge or to the heel measured horizontally.

For the purpose of determining roof rafter sizes in Table~~s~~ R804.3.2.1(1)~~ and R804.3.2.1(2)~~, ultimate design wind speeds shall be converted to equivalent ground snow loads in accordance with Table ~~R804.3.2.1(3).~~ R804.3.2.1(2). Roof rafter sizes shall be based on the higher of the ground snow load or the equivalent snow load converted from the ultimate design wind speed.

R804.3.2.1.1 Eave overhang. Eave overhangs shall not exceed 24 inches (610 mm) measured horizontally.

R804.3.2.1.2 Rake overhangs. Rake overhangs shall not exceed 12 inches (305 mm) measured horizontally. Outlookers at gable endwalls shall be installed in accordance with Figure R804.3.2.1.2.

R804.3.2.2 Roof rafter support brace. When used to reduce roof rafter spans in determining roof rafter sizes, a roof rafter support brace shall meet all of the following conditions:

1. Minimum 350S162-33 C-shaped brace member with maximum length of 8 feet (2438 mm).
2. Minimum brace member slope of 45 degrees (0.785 rad) to the horizontal.
3. Minimum connection of brace to a roof rafter and ceiling joist with four No.10 screws at each end.
4. Maximum 6 inches (152 mm) between brace/ceiling joist connection and load-bearing wall below.
5. Each roof rafter support brace greater than 4 feet (1219 mm) in length, shall be braced with a supplemental brace having a minimum size of 350S162-33 or 350T162-33 such that the maximum unsupported length of the roof rafter support brace is 4 feet (1219 mm). The supplemental brace shall be continuous and shall be connected to each roof rafter support brace using two No.8 screws.

TABLE R804.3.2.1(1)
ROOF RAFTER SPANS[a, b, c]
~~33 ksi STEEL~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN MEASURED HORIZONTALLY (feet-inches)~~							
	~~Ground snow load (psf)~~							
	~~20~~		~~30~~		~~50~~		~~70~~	
	~~Rafter spacing (inches)~~							
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~550S162-33~~	~~14'-0"~~	~~11'-6"~~	~~11'-11"~~	~~9'-7"~~	~~9'-6"~~	~~7'-9"~~	~~8'-2"~~	~~6'-8"~~
~~550S162-43~~	~~16'-8"~~	~~13'-11"~~	~~14'-5"~~	~~11'-9"~~	~~11'-6"~~	~~9'-5"~~	~~9'-10"~~	~~8'-0"~~
~~550S162-54~~	~~17'-11"~~	~~15'-7"~~	~~15'-7"~~	~~13'-3"~~	~~12'-11"~~	~~10'-7"~~	~~11'-1"~~	~~9'-1"~~
~~550S162-68~~	~~19'-2"~~	~~16'-9"~~	~~16'-9"~~	~~14'-7"~~	~~14'-1"~~	~~11'-10"~~	~~12'-6"~~	~~10'-2"~~
~~550S162-97~~	~~21'-3"~~	~~18'-6"~~	~~18'-6"~~	~~16'-2"~~	~~15'-8"~~	~~13'-8"~~	~~14'-0"~~	~~12'-2"~~
~~800S162-33~~	~~16'-5"~~	~~13'-5"~~	~~13'-11"~~	~~11'-4"~~	~~11'-1"~~	~~8'-2"~~	~~9'-0"~~	~~6'-0"~~
~~800S162-43~~	~~19'-9"~~	~~16'-1"~~	~~16'-8"~~	~~13'-7"~~	~~13'-4"~~	~~10'-10"~~	~~11'-5"~~	~~9'-4"~~
~~800S162-54~~	~~22'-8"~~	~~18'-6"~~	~~19'-2"~~	~~15'-8"~~	~~15'-4"~~	~~12'-6"~~	~~13'-1"~~	~~10'-8"~~
~~800S162-68~~	~~25'-10"~~	~~21'-2"~~	~~21'-11"~~	~~17'-10"~~	~~17'-6"~~	~~14'-4"~~	~~15'-0"~~	~~12'-3"~~
~~800S162-97~~	~~21'-3"~~	~~18'-6"~~	~~18'-6"~~	~~16'-2"~~	~~15'-8"~~	~~13'-8"~~	~~14'-0"~~	~~12'-2"~~
~~1000S162-43~~	~~22'-3"~~	~~18'-2"~~	~~18'-9"~~	~~15'-8"~~	~~15'-0"~~	~~12'-3"~~	~~12'-10"~~	~~10'-6"~~
~~1000S162-54~~	~~25'-8"~~	~~20'-11"~~	~~21'-8"~~	~~17'-9"~~	~~17'-4"~~	~~14'-2"~~	~~14'-10"~~	~~12'-1"~~
~~1000S162-68~~	~~29'-7"~~	~~24'-2"~~	~~25'-0"~~	~~20'-5"~~	~~20'-0"~~	~~16'-4"~~	~~17'-2"~~	~~14'-0"~~
~~1000S162-97~~	~~34'-8"~~	~~30'-4"~~	~~30'-4"~~	~~25'-10"~~	~~25'-3"~~	~~20'-8"~~	~~21'-8"~~	~~17'-8"~~
~~1200S162-54~~	~~28'-3"~~	~~23'-1"~~	~~23'-11"~~	~~19'-7"~~	~~19'-2"~~	~~15'-7"~~	~~16'-5"~~	~~13'-5"~~
~~1200S162-68~~	~~32'-10"~~	~~26'-10"~~	~~27'-9"~~	~~22'-8"~~	~~22'-2"~~	~~18'-1"~~	~~19'-0"~~	~~15'-6"~~
~~1200S162-97~~	~~40'-6"~~	~~33'-5"~~	~~34'-6"~~	~~28'-3"~~	~~27'-7"~~	~~22'-7"~~	~~23'-8"~~	~~19'-4"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Table provides maximum horizontal rafter spans in feet and inches for slopes between 3:12 and 12:12.~~

~~b. Deflection criterion: *L*/240 for live loads and *L*/180 for total loads.~~

~~c. Roof dead load = 12 psf.~~

TABLE R804.3.2.1(1)
ROOF RAFTER SPANS[a, b, c, d]

MEMBER DESIGNATION	ALLOWABLE SPAN MEASURED HORIZONTALLY (feet-inches)							
	Equivalent ground snow load (psf)							
	20		30		50		70	
	Rafter spacing (inches)							
	16	24	16	24	16	24	16	24
550S162-33	14'-0"	11'-6"	11'-11"	9'-7"	9'-6"	7'-9"	8'-2"	6'-8"
550S162-43	16'-8"	13'-11"	14'-5"	11'-9"	11'-6"	9'-5"	9'-10"	8'-0"
550S162-54	17'-11"	15'-7"	15'-7"	13'-8"	13'-2"	11'-6"	11'-9"	10'-3"
550S162-68	19'-2"	16'-9"	16'-9"	14'-7"	14'-1"	12'-4"	12'-7"	11'-0"
800S162-33	16'-5"	13'-5"	13'-11"	11'-4"	11'-1"	8'-2"	9'-0"	6'-0"
800S162-43	19'-9"	16'-1"	16'-8"	13'-7"	13'-4"	10'-10"	11'-5"	9'-4"
800S162-54	24'-2"	21'-2"	21'-1"	18'-5"	17'-10"	14'-8"	15'-5"	12'-7"
800S162-68	25'-11"	22'-8"	22'-8"	19'-9"	19'-1"	16'-8"	17'-1"	14'-9"
1000S162-43	22'-3"	18'-2"	18'-9"	15'-8"	15'-0"	12'-3"	12'-10"	10'-6"
1000S162-54	29'-0"	24'-6"	25'-4"	20'-9"	20'-3"	16'-7"	17'-5"	14'-2"
1000S162-68	31'-2"	27'-3"	27'-3"	23'-9"	20'-0"	19'-6"	20'-6"	16'-8"
1200S162-54	33'-2"	27'-1"	28'-1"	22'-11"	22'-5"	18'-4"	19'-3"	15'-8"
1200S162-68	36'-4"	31'-9"	31'-9"	27'-0"	26'-5"	21'-6"	22'-6"	18'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Table provides maximum horizontal rafter spans in feet and inches for slopes between 3:12 and 12:12.

b. Deflection criterion: *L*/240 for live loads and *L*/180 for total loads.

c. Roof dead load = 12 psf.

d. Grade 33 ksi steel is permitted to be used for 33 mil and 43 mil thicknesses. Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

~~**TABLE R804.3.2.1(2)**~~
~~**ROOF RAFTER SPANS[a, b, c]**~~
~~**50 ksi STEEL**~~

~~MEMBER DESIGNATION~~	~~ALLOWABLE SPAN MEASURED HORIZONTALLY (feet-inches)~~							
	~~Equivalent ground snow load (psf)~~							
	~~20~~		~~30~~		~~50~~		~~70~~	
	~~Rafter spacing (inches)~~							
	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~	~~16~~	~~24~~
~~550S162-33~~	~~15'-4"~~	~~12'-11"~~	~~13'-4"~~	~~10"-11"~~	~~10'-9"~~	~~8'-9"~~	~~9'-2"~~	~~7'-6"~~
~~550S162-43~~	~~16'-8"~~	~~14'-7"~~	~~14'-7"~~	~~12'-9"~~	~~12'-3"~~	~~10'-6"~~	~~11'-0"~~	~~9'-0"~~
~~550S162-54~~	~~17'-11"~~	~~15'-7"~~	~~15'-7"~~	~~13'-8"~~	~~13'-2"~~	~~11'-6"~~	~~11'-9"~~	~~10'-3"~~
~~550S162-68~~	~~19'-2"~~	~~16'-9"~~	~~16'-9"~~	~~14'-7"~~	~~14'-1"~~	~~12'-4"~~	~~12'-7"~~	~~11'-0"~~
~~550S162-97~~	~~21'-3"~~	~~18'-6"~~	~~18'-6"~~	~~16'-2"~~	~~15'-8"~~	~~13'-8"~~	~~14'-0"~~	~~12'-3"~~

~~800S162-33~~	~~18'-10"~~	~~15'-5"~~	~~15'-11"~~	~~12'-9"~~	~~12'-3"~~	~~8'-2"~~	~~9'-0"~~	~~6'-0"~~
~~800S162-43~~	~~22'-3"~~	~~18'-2"~~	~~18'-10"~~	~~15'-5"~~	~~15'-1"~~	~~12'-3"~~	~~12'-11"~~	~~10'-6"~~
~~800S162-54~~	~~24'-2"~~	~~21'-2"~~	~~21'-1"~~	~~18'-5"~~	~~17'-10"~~	~~14'-8"~~	~~15'-5"~~	~~12'-7"~~
~~800S162-68~~	~~25'-11"~~	~~22'-8"~~	~~22'-8"~~	~~19'-9"~~	~~19'-1"~~	~~16'-8"~~	~~17'-1"~~	~~14'-9"~~
~~800S162-97~~	~~28'-10"~~	~~25'-2"~~	~~25'-2"~~	~~22'-0"~~	~~21'-2"~~	~~18'-6"~~	~~19'-0"~~	~~16'-7"~~
~~1000S162-43~~	~~25'-2"~~	~~20'-7"~~	~~21'-4"~~	~~17'-5"~~	~~17'-0"~~	~~13'-11"~~	~~14'-7"~~	~~10'-7"~~
~~1000S162-54~~	~~29'-0"~~	~~24'-6"~~	~~25'-4"~~	~~20'-9"~~	~~20'-3"~~	~~16'-7"~~	~~17'-5"~~	~~14'-2"~~
~~1000S162-68~~	~~31'-2"~~	~~27'-3"~~	~~27'-3"~~	~~23'-9"~~	~~20'-0"~~	~~19'-6"~~	~~20'-6"~~	~~16'-8"~~
~~1000S162-97~~	~~34'-8"~~	~~30'-4"~~	~~30'-4"~~	~~26'-5"~~	~~25'-7"~~	~~22'-4"~~	~~22'-10"~~	~~20'-0"~~
~~1200S162-54~~	~~33'-2"~~	~~27'-1"~~	~~28'-1"~~	~~22'-11"~~	~~22'-5"~~	~~18'-4"~~	~~19'-3"~~	~~15'-8"~~
~~1200S162-68~~	~~36'-4"~~	~~31'-9"~~	~~31'-9"~~	~~27'-0"~~	~~26'-5"~~	~~21'-6"~~	~~22'-6"~~	~~18'-6"~~
~~1200S162-97~~	~~40'-6"~~	~~35'-4"~~	~~35'-4"~~	~~30'-11"~~	~~29'-10"~~	~~26'-1"~~	~~26'-8"~~	~~23'-1"~~

~~For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Table provides maximum horizontal rafter spans in feet and inches for slopes between 3:12 and 12:12.~~
~~b. Deflection criterion: *L*/240 for live loads and *L*/180 for total loads.~~
~~c. Roof dead load = 12 psf.~~

TABLE ~~R804.3.2.1(3)~~ R804.3.2.1(2)
~~BASIC~~ ULTIMATE DESIGN WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION

~~BASIC~~ ULTIMATE DESIGN WIND SPEED (mph) AND EXPOSURE CATEGORY		EQUIVALENT GROUND SNOW LOAD (psf) Roof slope									
~~Exp.~~ B	~~Exp.~~ C	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:12
~~85 mph~~	—	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~20~~	~~30~~	~~30~~	~~30~~	~~30~~
~~100~~126 ~~mph~~	~~85~~110~~mph~~	20	20	20	20	30	30	30	30	50	50
~~110~~<139 ~~mph~~	~~100~~126~~ mph~~	20	20	20	20	30	50	50	50	50	50
—	~~110~~<139~~mph~~	30	30	30	50	50	50	70	70	70	—

For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

R804.3.2.3 Roof rafter splice. Roof rafters shall not be spliced.

R804.3.2.4 Roof rafter to ceiling joist and ridge member connection. Roof rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with Figure R804.3.1.1~~(1) or R804.3.1.1(2)~~ and Table ~~R804.3.1.1(9).~~ R804.3.1.1(3). Ceiling joists shall be connected to the top track of the load-bearing wall in accordance with Table R804.3, either with ~~two~~ the required number of No. 10 screws applied through the flange of the ceiling joist or by using a 54-mil (1.37 mm) clip angle with ~~two~~ the required number of No.10 screws in each leg. Roof rafters shall be connected to a ridge member with a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle fastened with No. 10 screws to the ridge member in accordance with Figure R804.3.2.4 and Table R804.3.2.4. The clip angle shall have a steel thickness equivalent to or greater than the roof rafter thickness and shall extend the depth of the roof rafter member to the extent possible. The ridge member shall be fabricated from a C-shaped member and a track section, which shall have a minimum size and steel thickness equivalent to or greater than that of adjacent roof rafters and shall be installed in accordance with Figure R804.3.2.4. The ridge member shall extend the full depth of the sloped roof rafter cut.

R804.3.2.5 Roof rafter bottom flange bracing. The bottom flanges of roof rafters shall be continuously braced, at a maximum spacing of 8 feet (2440 mm) as measured parallel to the roof rafters, with one of the following members:

1. Minimum 33-mil (0.84 mm) C-shaped member.
2. Minimum 33-mil (0.84 mm) track section.
3. Minimum $1^1/_2$-inch by 33-mil (38 mm by 0.84 mm) steel strap.

The bracing element shall be fastened to the bottom flange of each roof rafter with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between roof rafters in-line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the roof rafters. The ends of continuous bracing shall be fastened to blocking or anchored to a stable building component with two No. 8 screws.

FIGURE R804.3.2.4 ~~HIP MEMBER OR~~ RIDGE MEMBER CONNECTION

(No change to Figure)

TABLE R804.3.2.4
SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR ~~HIP RAFTER TO HIP MEMBER OR~~ ROOF RAFTER TO RIDGE MEMBER CONNECTION[a]

BUILDING WIDTH (feet)	NUMBER OF SCREWS			
	Ground snow load (psf)			
	0 to 20	21 to 30	31 to 50	51 to 70
24	2	2	3	4
28	2	3	4	5
32	2	3	4	5
36	3	3	5	6
40	3	4	5	7

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.
a. Screws shall be No. 10 minimum.

~~**R804.3.3 Hip framing.** Hip framing shall consist of jack-rafters, hip members, hip support columns and connections in accordance with this section, or shall be in accordance with an *approved* design. The provisions of this section for hip members and hip support columns shall apply only where the jack rafter slope is greater than or equal to the roof slope. For the purposes of determining member sizes in this section, wind speeds shall be converted to equivalent ground snow load in accordance with Table R804.3.2.1(3).~~

~~**R804.3.3.1 Jack rafters.** Jack rafters shall meet the requirements for roof rafters in accordance with Section R804.3.2, except that the requirements in Section R804.3.2.4 shall not apply.~~

~~**R804.3.3.2 Hip members.** Hip members shall be fabricated from C-shape members and track section, which shall have minimum sizes determined in accordance with Table R804.3.3.2. The C-shape member and track section shall be connected at a maximum spacing of 24 inches (610 mm) using No. 10 screws through top and bottom flanges in accordance with Figure R804.3.2.4. The depth of the hip member shall match that of the roof rafters and jack rafters, or shall be based on an *approved* design for a beam pocket at the corner of the supporting wall.~~

~~**TABLE R804.3.3.2 HIP MEMBER SIZES, 33 ksi STEEL**~~

~~BUILDING WIDTH (feet)~~	~~HIP MEMBER DESIGNATION[a]~~			
	~~Equivalent ground snow load (psf)~~			
	~~0 to 20~~	~~21 to 30~~	~~31 to 50~~	~~51 to 70~~

~~24~~	~~800S162-68~~ ~~800T150-68~~	~~800S162-68~~ ~~800T150-68~~	~~800S162-97~~ ~~800T150-97~~	~~1000S162-97~~ ~~1000T150-97~~
~~28~~	~~1000S162-68~~ ~~1000T150-68~~	~~1000S162-68~~ ~~1000T150-68~~	~~1000S162-97~~ ~~1000T150-97~~	~~1200S162-97~~ ~~1200T150-97~~
~~32~~	~~1000S162-97~~ ~~1000T150-97~~	~~1000S162-97~~ ~~1000T150-97~~	~~1200S162-97~~ ~~1200T150-97~~	~~—~~
~~36~~	~~1200S162-97~~ ~~1200T150-97~~	~~—~~	~~—~~	~~—~~
~~40~~	~~—~~	~~—~~	~~—~~	~~—~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. The web depth of the roof rafters and jack rafters is to match at the hip or they shall be installed in accordance with an approved design.~~

~~**R804.3.3.3 Hip support columns.** Hip support columns shall be used to support hip members at the ridge. A hip support column shall consist of a pair of C-shape members, with a minimum size determined in accordance with Table R804.3.3.3. The C-shape members shall be connected at a maximum spacing of 24 inches (610 mm) on center to form a box using minimum 3-inch by 33-mil (76 mm by 0.84 mm) strap connected to each of the flanges of the C-shape members with three-No. 10 screws. Hip support columns shall have a continuous load path to the foundation and shall be supported at the ceiling line by an interior wall or by an *approved* design for a supporting element.~~

~~TABLE R804.3.3.3 HIP SUPPORT COLUMN SIZES~~

~~BUILDING WIDTH (feet)~~	**~~HIP SUPPORT COLUMN DESIGNATION~~[a, b]**			
	~~Equivalent ground snow load (psf)~~			
	~~0 to 20~~	**~~21 to 30~~**	**~~31 to 50~~**	**~~51 to 70~~**
~~24~~	~~2-350S162-33~~	~~2-350S162-33~~	~~2-350S162-43~~	~~2-350S162-54~~
~~28~~	~~2-350S162-54~~	~~2-550S162-54~~	~~2-550S162-68~~	~~2-550S162-68~~
~~32~~	~~2-550S162-68~~	~~2-550S162-68~~	~~2-550S162-97~~	~~—~~
~~36~~	~~2-550S162-97~~	~~—~~	~~—~~	~~—~~
~~40~~	~~—~~	~~—~~	~~—~~	~~—~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. VBox shape column only in accordance with Figure R804.3.3.4(2).~~

~~b. 33 ksi steel for 33 and 43 mil material; 50 ksi steel for thicker material.~~

~~**R804.3.3.4 Hip framing connections.** Hip rafter framing connections shall be installed in accordance with the following:~~

1. ~~Jack rafters shall be connected at the eave to a parallel C-shape blocking member in accordance with Figure R804.3.3.4(1). The C-shape blocking member shall be attached to the supporting wall track with minimum two No. 10 screws.~~
2. ~~Jack rafters shall be connected to a hip member with a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle fastened with No.10 screws to the hip member in accordance with Figure R804.3.2.4 and Table R804.3.2.4. The clip angle shall have a steel thickness equivalent to or greater than the jack rafter thickness and shall extend the depth of the jack rafter member to the extent possible.~~
3. ~~The connection of the hip support columns at the ceiling line shall be in accordance with Figure R804.3.3.4(2), with an uplift strap sized in accordance with Table R804.3.3.4(1).~~
4. ~~The connection of hip support members, ridge members and hip support columns at the ridge shall be in accordance with Figures R804.3.3.4(3) and R804.3.3.4(4) and Table R804.3.3.4(2).~~
5. ~~The connection of hip members to the wall corner shall be in accordance with Figure R804.3.3.4(5) and Table R804.3.3.4(3).~~

~~TABLE R804.3.3.4(1) UPLIFT STRAP CONNECTION REQUIREMENTS HIP SUPPORT COLUMN AT CEILING LINE~~

~~BUILDING WIDTH (feet)~~	~~BASIC WIND SPEED (mph) EXPOSURE B~~				
	~~85~~	~~100~~	~~110~~	—	—
	~~BASIC WIND SPEED (mph) EXPOSURE C~~				
	—	~~85~~	—	~~100~~	~~110~~
	~~Number of No. 10 screws in each end of each 3 inch by 54-mil steel strap~~[a, b, c]				
~~24~~	~~3~~	~~4~~	~~4~~	~~6~~	~~7~~
~~28~~	~~4~~	~~6~~	~~6~~	~~8~~	~~10~~
~~32~~	~~5~~	~~8~~	~~8~~	~~11~~	~~13~~
~~36~~	~~7~~	~~10~~	~~11~~	~~14~~	~~17~~
~~40~~	—	—	—	—	—

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.~~

~~a. Two straps are required, one each side of the column.~~

~~b. Space screws at ¾ inch on-center and provide ¾ inch end distance.~~

~~c. 50 ksi steel strap.~~

~~FIGURE R804.3.3.4(1) JACK RAFTER CONNECTION AT EAVE~~

~~TABLE R804.3.3.4(2) CONNECTION REQUIREMENTS HIP MEMBER TO HIP SUPPORT COLUMN~~

~~BUILDING WIDTH (feet)~~	~~NUMBER OF NO. 10 SCREWS IN EACH FRAMING ANGLE~~[a, b, c]			
	~~Equivalent ground snow load (psf)~~			
	~~0 to 20~~	~~21 to 30~~	~~31 to 50~~	~~51 to 70~~
~~24~~	~~10~~	~~10~~	~~10~~	~~12~~
~~28~~	~~10~~	~~10~~	~~14~~	~~18~~
~~32~~	~~10~~	~~12~~	—	—
~~36~~	~~14~~	—	—	—
	—	—	—	—

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.~~

~~a. Screws to be divided equally between the connection to the hip member and the column. Refer to Figures R804.3.3.4(3) and R804.3.3.4(4).~~

~~b. The number of screws required in each framing angle is not to be less than shown in Table R804.3.3.4(1).~~

~~c. 50 ksi steel from the framing angle.~~

~~FIGURE 804.3.3.4(2) HIP SUPPORT COLUMN~~

~~TABLE R804.3.3.4(3) UPLIFT STRAP CONNECTION REQUIREMENTS HIP MEMBER TO WALL~~

~~BUILDING WIDTH (feet)~~	~~BASIC WIND SPEED (mph) EXPOSURE B~~				
	~~85~~	~~100~~	~~110~~	—	—
	~~BASIC WIND SPEED (mph) EXPOSURE C~~				
	—	~~85~~	—	~~100~~	~~110~~
	~~Number of No. 10 screws in each end of each 3 inch by 54-mil Steel strap~~[a, b, c]				
~~24~~	~~2~~	~~2~~	~~3~~	~~3~~	~~4~~
~~28~~	~~2~~	~~3~~	~~3~~	~~4~~	~~5~~
~~32~~	~~3~~	~~4~~	~~4~~	~~6~~	~~7~~
~~36~~	~~3~~	~~5~~	~~5~~	~~7~~	~~8~~

~~40~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~a. Two straps are required, one each side of the column.~~

~~b. Space screws at ¾ inches on-center and provide ¾ inch end distance.~~

~~c. 50 ksi steel strap.~~

~~FIGURE R804.3.3.4(3) HIP CONNECTIONS AT RIDGE~~

~~FIGURE R804.3.3.4(4) HIP CONNECTIONS AT RIDGE AND BOX COLUMN~~

~~FIGURE R804.3.3.4(5) HIP MEMBER CONNECTION AT WALL CORNER~~

~~R804.3.4~~ R804.3.4 Cutting and notching. Flanges and lips of load-bearing, cold-formed steel roof framing members shall not be cut or notched.

~~R804.3.5~~ R804.3.4 Headers. Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in load-bearing walls shall not exceed the values set forth in Section R603.6 and Tables R603.6(1) through ~~R603.6(24).~~ R603.6(6)

~~R804.3.6~~ R804.3.5 Framing of openings in roofs and ceilings. Openings in roofs and ceilings shall be framed with header and trimmer joists. Header joist spans shall not exceed 4 feet (1219 mm) in length. Header and trimmer joists shall be fabricated from joist and track members having a minimum size and thickness at least equivalent to the adjacent ceiling joists or roof rafters and shall be installed in accordance with Figures ~~R804.3.6(1)~~ R804.3.5(1) and ~~R804.3.6(2).~~ R804.3.5(2) Each header joist shall be connected to trimmer joists with a minimum of four 2-inch by 2-inch (51 by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The steel thickness of the clip angles shall be not less than that of the ceiling joist or roof rafter. Each track section for a built-up header or trimmer joist shall extend the full length of the joist (continuous).

~~R804.3.7~~ R804.3.6 Roof trusses. Cold-formed steel trusses shall be designed and installed in accordance with AISI S100, Section D4. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA *Cold-Formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses*. Trusses shall be connected to the top track of the load-bearing wall in accordance with Table R804.3, either with two No. 10 screws applied through the flange of the truss or by using a 54-mil (1.37 mm) clip angle with two No. 10 screws in each leg.

FIGURE ~~R804.3.6(1)~~ R804.3.5(1) ROOF OR CEILING OPENING

(No change to Figure)

FIGURE ~~R804.3.6(2)~~ R804.3.5(2) HEADER TO TRIMMER CONNECTION

(No change to Figure)

~~R804.3.8~~ R804.3.7 Ceiling and roof diaphragms. Ceiling and roof diaphragms shall be in accordance with this section.

~~R804.3.8.1~~ R804.3.7.1 Ceiling diaphragms. At gable endwalls a ceiling *diaphragm* shall be provided by attaching a minimum $^1/_2$-inch (12.7 mm) gypsum board ~~in accordance with Tables R804.3.8(1) and R804.3.8(2)~~ or a minimum $^3/_8$-inch (9.5 mm) wood structural panel sheathing, which complies with Section R803, ~~in accordance with Table R804.3.8(3)~~ to the bottom of ceiling joists or roof trusses and connected to wall framing in accordance with Figures ~~R804.3.8(1)~~ R804.3.7.1(1) and ~~R804.3.8(2)~~ R804.3.7.1(2), unless studs are designed as full height without bracing at the ceiling. Flat blocking shall consist of C-shape or track section with a minimum thickness of 33 mils (0.84 mm).

For a gypsum board sheathed ceiling, the diaphragm length shall be in accordance with Table R804.3.7.1. For a wood structural panel sheathed ceiling, the diaphragm length shall be a minimum of 12 ft (3658 mm) for building widths less than 36 feet (10,973 mm), or be a minimum of 14 ft (4267 mm) for building widths greater than or equal to 36 feet.

The ceiling *diaphragm* shall be secured with screws spaced at a maximum 6 inches (152 mm) o.c. at panel edges and a maximum 12 inches (305 mm) o.c. in the field. Multiplying the required lengths in Table~~s~~ ~~R804.3.8(1) and R804.3.8(2)~~ R804.3.7.1 for gypsum board sheathed ceiling diaphragms shall be permitted to be multiplied by 0.35 shall be permitted if all panel edges are blocked. Multiplying the required lengths in Tables ~~R804.3.8(1) and R804.3.8(2)~~ R804.3.7.1 for gypsum board sheathed ceiling diaphragms by 0.9 shall be permitted if all panel edges are secured with screws spaced at 4 inches (102 mm) o.c.

~~R804.3.8.2~~ R804.3.7.2 Roof diaphragm. A roof *diaphragm* shall be provided by attaching a minimum of $^3/_8$-inch (9.5 mm) wood structural panel which complies with Section R803 to roof rafters or truss top chords in accordance with Table R804.3. Buildings with 3:1 or larger plan *aspect ratio* and with roof rafter slope (pitch) of 9:12 or larger shall have the roof rafters and ceiling joists blocked in accordance with Figure ~~R804.3.8(3).~~ R804.3.7.2

~~R804.3.9~~ R804.3.8 Roof tie-down. Roof assemblies ~~subject to wind uplift pressures of 20 pounds per square foot (0.96 kPa) or greater, as established in Table R301.2(2),~~ shall ~~have rafter-to-bearing~~be connected to walls below ~~ties provided~~ in accordance with Table ~~R802.11~~ R804.3. A continuous load path shall be provided to transfer uplift loads to the foundation.

TABLE ~~R804.3.8(1)~~ R804.3.7.1 REQUIRED LENGTHS FOR CEILING DIAPHRAGMS AT GABLE ENDWALLS GYPSUM BOARD SHEATHED, CEILING HEIGHT = 8 FT [a,b,c,d,e,f, g]

		~~BASIC~~ ULTIMATE DESIGN WIND SPEED (mph)				
Exposure Category B		**~~85~~**	~~100~~126	~~110~~<139	**—**	**—**
Exposure Category C		**—**	~~85~~110	**—**	~~100~~126	~~110~~<139
Roof pitch	**Building endwall width (feet)**	**Minimum diaphragm length (feet)**				
3:12 to 6:12	24 - 28	~~14~~	20	22	28	32
	28 - 32	~~16~~	22	28	32	38
	32 - 36	~~20~~	26	32	38	44
	36 - 40	~~22~~	30	36	44	50
6:12 to 9:12	24 - 28	~~16~~	22	26	32	36
	28 - 32	~~20~~	26	32	38	44
	32 - 36	~~22~~	32	38	44	52
	36 - 40	~~26~~	36	44	52	60
9:12 to 12:12	24 - 28	~~18~~	26	30	36	42
	28 - 32	~~22~~	30	36	42	50
	32 - 36	~~26~~	36	42	50	60
	36 - 40	~~30~~	42	50	60	70

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

a. Ceiling diaphragm is composed of ½ inch gypsum board (min. thickness) secured with screws spaced at 6 inches 0.c. at panel edges and 12 inches 0.c. infield. Use No. 8 screws (min.) when framing members have a designation thickness of 54 mils or less and No. 10 screws (min.) when framing members have a designation thickness of greater than 54 mils.
b. Maximum aspect ratio (length/width) of diaphragms is 2:1.
c. Building width is in the direction of horizontal framing members supported by the all studs.
d. Required diaphragm lengths are to be provided at each end of the structure.
e. Multiplying required diaphragm lengths by 0.35 is permitted if all panel edges are blocked.
f. Multiplying required diaphragm lengths by 0.9 is permitted if all panel edges are secured with screws spaced at 4 inches o.c.

g. To determine the minimum diaphragm length for buildings with ceiling heights of 9 ft (2743mm) or 10 ft (3048mm), values in the table above shall be multiplied by 1.15.

FIGURE ~~R804.3.8(1)~~ R804.3.7.1(1) CEILING DIAPHRAGM TO GABLE ENDWALL DETAIL

(No change to Figure)

~~TABLE R804.3.8(2)~~
~~REQUIRED LENGTHS FOR CEILING DIAPHRAGMS AT GABLE ENDWALLS GYPSUM BOARD SHEATHED CEILING HEIGHT = 9 OR 10 FT[a,b,c,d,e,f]~~

~~Exposure B~~		~~BASIC WIND SPEED (mph)~~				
		~~85~~	~~100~~	~~110~~	~~—~~	~~—~~
~~Exposure C~~		~~—~~	~~85~~	~~—~~	~~100~~	~~110~~
~~Roof pitch~~	~~Building endwall width (feet)~~	~~Minimum diaphragm length (feet)~~				
~~3:12 to 6:12~~	~~24 - 28~~	~~16~~	~~22~~	~~26~~	~~32~~	~~38~~
	~~28 - 32~~	~~20~~	~~26~~	~~32~~	~~38~~	~~44~~
	~~32 - 36~~	~~22~~	~~30~~	~~36~~	~~44~~	~~50~~
	~~36 - 40~~	~~26~~	~~36~~	~~42~~	~~50~~	~~58~~
~~6:12 to 9:12~~	~~24 - 28~~	~~18~~	~~26~~	~~30~~	~~36~~	~~42~~
	~~28 - 32~~	~~22~~	~~30~~	~~36~~	~~42~~	~~50~~
	~~32 - 36~~	~~26~~	~~36~~	~~42~~	~~50~~	~~58~~
	~~36 - 40~~	~~30~~	~~42~~	~~48~~	~~58~~	~~68~~
~~9:12 to 12:12~~	~~24 - 28~~	~~20~~	~~28~~	~~34~~	~~40~~	~~46~~
	~~28 - 32~~	~~24~~	~~34~~	~~40~~	~~48~~	~~56~~
	~~32 - 36~~	~~28~~	~~40~~	~~48~~	~~56~~	~~66~~
	~~36 - 40~~	~~34~~	~~46~~	~~56~~	~~66~~	~~78~~

~~For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.~~

~~a. Ceiling diaphragm is composed of ½ inch gypsum board (min. thickness) secured with screws spaced at 6 inches 0.c. at panel edges and 12 inches 0.c. infield. Use No. 8 screws (min.) when framing members have a designation thickness of 54 mils or less and No. 10 screws (min.) when framing members have a designation thickness of greater than 54 mils.~~
~~b. Maximum aspect ratio (length/width) of diaphragms is 2:1.~~
~~c. Building width is in the direction of horizontal framing members supported by the all studs.~~
~~d. Required diaphragm lengths are to be provided at each end of the structure.~~
~~e. Multiplying required diaphragm lengths by 0.35 is permitted if all panel edges are blocked.~~
~~f. Multiplying required diaphragm lengths by 0.9 is permitted if all panel edges are secured with screws spaced at 4 inches o.c.~~

FIGURE ~~R804.3.8(2)~~ R804.3.7.1(2) CEILING DIAPHRAGM TO SIDEWALL DETAIL

(No change to Figure)

~~TABLE R804.3.8(3) REQUIRED LENGTHS FOR CEILING DIAPHRAGMS AT GABLE ENDWALLS WOOD STRUCTURAL PANEL SHEATHED CEILING HEIGHT = 8, 9 OR 10 FT[a, b, c, d]~~

~~Exposure B~~		~~BASIC WIND SPEED (mph)~~				
		~~85~~	~~100~~	~~110~~	~~—~~	~~—~~
~~Exposure C~~		~~—~~	~~85~~	~~—~~	~~100~~	~~110~~
~~Roof pitch~~	~~Building endwall width (feet)~~	~~Minimum diaphragm length (feet)~~				
~~3:12 to~~	~~24 - 28~~	~~10~~	~~10~~	~~10~~	~~10~~	~~10~~

~~6:12~~	~~28 - 32~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~32 - 36~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~36 - 40~~	~~14~~	~~14~~	~~14~~	~~14~~	~~14~~
~~6:12 to 9:12~~	~~24 - 28~~	~~10~~	~~10~~	~~10~~	~~10~~	~~10~~
	~~28 - 32~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~32 - 36~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~36 - 40~~	~~14~~	~~14~~	~~14~~	~~14~~	~~14~~
~~9:12 to 12:12~~	~~24 - 28~~	~~10~~	~~10~~	~~10~~	~~10~~	~~10~~
	~~28 - 32~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~32 - 36~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~
	~~36 - 40~~	~~14~~	~~14~~	~~14~~	~~14~~	~~14~~

~~For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.~~

~~a. Ceiling diaphragm is composed of ½ inch gypsum board (min. thickness) secured with screws spaced at 6 inches 0.c. at panel edges and 12 inches 0.c. infield. Use No. 8 screws (min.) when framing members have a designation thickness of 54 mils or less and No. 10 screws (min.) when framing members have a designation thickness of greater than 54 mils.~~

~~b. Maximum aspect ratio (length/width) of diaphragms is 2:1.~~

~~c. Building width is in the direction of horizontal framing members supported by the all studs.~~

~~d. Required diaphragm lengths are to be provided at each end of the structure.~~

FIGURE ~~R804.8(3)~~ R804.7.2 ROOF BLOCKING DETAIL

(No change to Figure)

Revise as follows:

M1308.1 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, R603.2.5 and R804.2.6~~5~~. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.3~~4~~, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Revise as follows:

M2101.6 Drilling and notching. Wood-framed structural members shall be drilled, notched or altered in accordance with the provisions of Sections R502.8, R602.6, R602.6.1 and R802.7. Holes in load bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, R603.2.5 and R804.2.6~~5~~. In accordance with the provisions of Sections R505.3.5, R603.3.4 and R804.3.3~~4~~, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.

Revise as follows:

P2603.2 Drilling and notching. Wood-framed structural members shall not be drilled, notched or altered in any manner except as provided in Sections R502.8, R602.6, R802.7 and R802.7.1. Holes in load-bearing members of cold-formed steel light-frame construction shall be permitted only in accordance with Sections R505.2.5, R603.2.5 and R804.2.6~~5~~. In accordance with the provisions in Sections R505.3.5, R603.3.4 and R804.3.3~~4~~, cutting and notching of flanges and lips of load-bearing members of cold-formed steel light frame construction shall not be permitted. Structural insulated panels (SIPs) shall be drilled and notched or altered in accordance with the provisions of Section R613.7.

Reason: This proposal is one in a series intended to both update and streamline the cold-formed steel (CFS) light frame construction provisions of the IRC. The revisions are based upon recommendations made by the AISI Committee on Framing Standards (COFS) Prescriptive Methods Subcommittee, which is responsible for the requirements' base document -- AISI S230, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings.* For the most part, the changes are editorial in nature and work to focus the cold-formed steel solutions presented in the IRC on the most popular and readily available options. The changes also align the cold-formed steel provisions with the latest reference standards, including AISI S230-07 w/S3-12, *Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings,* 2007, with Supplement 3, 2012.

Changes specific to Section R804 include the following:

- **R804:** Title correction.
- **R804.1**: The wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial adjustments are made to the language. The design wind speeds are changed based upon the following direct conversion table, which was incorporated into AISI S230-07 w/S3-12:

ASCE 7-10 Wind Speed (mph)	110	115	126	139	152	164	177	190
AISI S230 Wind Speed (mph)	85	90	100	110	120	130	140	150

- **R804.2:** Requirements are relocated to new Section R804.2.3, which is specific to dimension, thickness and material grade.
- **R804.2.1:** The references to ASTM A653 and ASTM A792 are deleted. Since these materials are included under ASTM A1003, they do not need to be repeated in this section.
- **R804.2.2:** The corrosion protection requirements are relocated from Section R804.2.3 for better flow in section.
- **R804.2.3:** Requirements from Section R804.2 are relocated into new section on dimension, thickness and material grade and Table R804.2(1) and Table R804.2(2) are combined into new Table R804.2.3. The minimum flange width, maximum flange width, and minimum lip size are moved into the charging language for the table, since these properties do not vary based upon the member designation. Also, to further streamline the provisions, the most popular and readily available grade-thickness combinations are being retained and the less popular and readily available grade-thickness combinations are being removed. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added to Section R804.2.3. Finally, the reference to 97 mil product is deleted. It is very uncommon in residential construction, and, if need be, the user can still use AISI S230, where solutions include 97 mil product.
- **R804.2.5:** The title is fixed to match others in section and the screw substitution factor is eliminated. This is seldom used in prescriptive design and adds complexity to the provisions.
- **Figures R804.2.6.1, R804.2.6.3, and R804.3:** Title correction.
- **R804.3:** Since Section R804.3.3, on hip roof framing, is recommended for deletion, coordinating text is also recommended for deletion. In Table R804.3, the wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the column headings to clarify the applicability of the CFSF provisions. Finally, entries on ceiling joist or roof truss to top track of bearing wall are brought into agreement with AISI S230-07 w/S3-12, which includes modifications to the table notes.
- **R804.3.1.1:** The tables for continuous ceiling joists and ceiling joists with bearing stiffeners are deleted. These add volume and complexity, but do not provide significant improvement over the single span tables and tables without bearing stiffeners. If need be, users can conservatively use the single span ceiling joist tables without bearing stiffeners – now Tables R804.3.1.1(1) and R804.3.1.1(2) – in all situations or they can also go back to AISI S230. To be consistent with changes in other sections, Tables R804.3.1.1(1) and R804.3.1.1(2) now each address both Grade 33 ksi and Grade 50 ksi. For Grade 33 ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added in new table notes. Please note that, while Grade 50 ksi steel is now required for 54 mil and 68 mil product, no changes are made to the allowable spans, thus resulting in additional conservatism. Finally, the reference to 97 mil product is deleted.
- **R804.3.1.2:** The tables for ceiling joists with bearing stiffeners are deleted in Section R804.3.1.1, so this section on ceiling joist bearing stiffeners is not needed.
- **R804.3.2:** The language in the section associated with wind speeds is updated to reflect "ultimate" design wind speeds from ASCE 7-10. A new Table R804.3.2.1(1) is created by combining the Grade 33ksi and 50 ksi tables. For Grade 33

ksi steel, 33 and 43 mil thicknesses are specified; while, for Grade 50 ksi steel, 54 mil and 68 mil thicknesses are specified. This language is added in a new table note. Also, the 97 mil product is eliminated from the table. Additionally, the newly renumbered Table R804.3.2.1(2), updates the wind speeds to reflect the "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the row headings to clarify the applicability of the CFSF provisions. Finally, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated. Provisions at this lower wind speed are not substantively different than at the next higher wind speed.

- **R804.3.2.4:** The number of required screws is brought into agreement with AISI S230-07 w/S3-12, which may now require more than two screws in accordance with Table R804.3.
- **Figure R804.3.2.4 and Table R804.3.2.4:** Since Section R804.3.3 is recommended for deletion, coordinating text is also recommended for deletion.
- **R804.3.3:** The CFS hip roof framing provisions are deleted in the IRC. This section adds volume and complexity, but does not provide significant improvement. If need be, users can go back to AISI S230 for hip roof framing design options.
- **R804.3.7:** Existing Table R804.3.8(2) for gypsum ceiling diaphragms where ceiling height is 9 or 10 feet is replaced with a table note in Table R804.7(1) (renumbered Table R804.3.8(1)). Existing Table R804.3.8(3) for wood structural panel ceiling diaphragms is replaced in the section with text. Both changes eliminate extraneous tables, providing a more streamlined solution. In Table R804.7(1), the wind speeds are updated to reflect "ultimate" design wind speeds from ASCE 7-10 and editorial modifications are made to the column headings to clarify the applicability of the CFSF provisions. Also, an unnecessary wind speed – 110 mph (old 85 mph) Exposure Category B – is eliminated. Provisions at this lower wind speed are not substantively different than at the next higher wind speed.
- **R804.3.8:** The language on roof tie-down is brought into agreement with AISI S230-07 w/S3-12 through a reference to the newly modified Table R804.3.
- **M1308.1, M2101.6, and P2603.2**: Cross-references are updated in each of these sections.

Cost Impact: The code change proposal will not increase the cost of construction.

RB400-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R804-RB-MANLEY.doc

RB401 – 13
R806.1

Proponent: Michael D. Fischer, Kellen Company, representing the Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

R806.1 Ventilation required. Enclosed *attics* and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum.
Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

> ~~**Exception:** Attic ventilation shall not be required when determined not necessary by the code official due to atmospheric or climatic conditions.~~

Reason: With recent revisions to the IRC roof ventilation requirements, and an IBC change approved last year, both codes now contain specific details on both vented and unvented attics with detailed requirements related to the use of vapor retarders and climate specific instructions on the use of air-impermeable insulation. Now that the IRC contains these provisions, the current exception creates a conflict and an unnecessary alternative. Additionally, since the exception is based on climatic conditions, with no direction to the code official on matters related to construction methods or details, it cannot be applied on a project-by-project basis.

Cost Impact: The code change proposal will not increase the cost of construction.

RB401-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R806.1-RB-FISCHER.doc

RB402 – 13
R806.1, R806.2, R806.3, R806.4, R806.5

Proponent: Charles S. Bajnai, Chesterfield County, VA,, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov), Joseph Lstiburek, Building Science Corporation

Revise as follows:

SECTION R806
ROOF VENTILATION

~~**R806.1 Ventilation required.** Enclosed *attics* and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.~~

> ~~**Exception:** Attic ventilation shall not be required when determined not necessary by the code official due to atmospheric or climatic conditions.~~

~~**R806.2 Minimum vent area.** The minimum net free ventilating area shall be 1/150 of the area of the vented space.~~

> ~~**Exception:** The minimum net free ventilation area shall be 1/300 of the vented space provided one or more of the following conditions are met:~~
>
> 1. ~~In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.~~
> 2. ~~At least 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.~~

R806.1 Ventilation. The requirements for vented and unvented attic space and enclosed rafter space shall be in accordance with this section.

R806.2 Vented attics. Vented attics shall have a minimum net free ventilation area at least 1/300 of the area of the vented space. Between half and two thirds of the provided ventilation shall be installed at the eaves. The ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

~~**R806.3 Vent and insulation clearance.**~~ Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

~~R806.4~~ <u>R806.2.1</u> **Installation and weather protection.** Ventilators shall be installed in accordance with manufacturer's installation instructions. Installation of ventilators in roof systems shall be in accordance with the requirements of Section R903. Installation of ventilators in wall systems shall be in accordance with the requirements of Section R703.1.

~~R806.5~~ <u>R806.3</u> **Unvented attic and unvented enclosed rafter assemblies**. Unvented *attic* assemblies (spaces between the ceiling joists of the top *story* and the roof rafters) and unvented enclosed rafter assemblies (spaces between ceilings that are applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members/rafters) shall be permitted if all the following conditions are met:

1. The unvented *attic* space is completely contained within the *building thermal envelope.*
2. No interior Class I vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed rafter assembly.
3. Where wood shingles or shakes are used, a minimum $^{1}/_{4}$-inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class III vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Either Items 5.1, 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
   - 5.1. *Air-impermeable insulation* only. Insulation shall be applied in direct contact with the underside of the structural roof sheathing.
   - 5.2. Air-permeable insulation only. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.5 for condensation control.
   - 5.3. Air-impermeable and air-permeable insulation. The *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the *air-impermeable insulation.*
   - 5.4. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

1. This section was rewritten to clarify vented and unvented attics. The current charging language in the first sentence of Section R806.1 says that all attics shall have cross ventilation, and yet Section R806.5 acknowledges unvented attics. The new Section R806.1 offers charging language for both conditions.
2. More importantly however, Section 806.2 now incorporates the concepts that were passed in Portland for the IBC, namely that more than half of the incoming ventilation for attics should come from low sources (eaves) and exit up high (roof vent, mechanical vents, gable end vents, etc.). A range is provided: ½ to 2/3 should be low at the eaves for proper chimney effect. Currently the code would allow 100% of the attic ventilation to be from ridge vents…where would the cross ventilation come from?

Cost Impact: The code change proposal will not increase the cost of construction.

RB402-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R806.1-RB-BAJNAI-BCAC.doc

RB403 – 13
R806.5

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented ~~*attic* assemblies (spaces between the ceiling joists of the top *story* and the roof rafters)~~ attics and unvented enclosed rafter assemblies (spaces between ceilings that are applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members/rafters) shall be permitted if all the following conditions are met:

1. The unvented *attic* space is completely contained within the *building thermal envelope.*
2. No interior Class I vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed rafter assembly.
3. Where wood shingles or shakes are used, a minimum 1/4-inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class III vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Either Items 5.1, 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
   5.1. *Air-impermeable insulation* only. Insulation shall be applied in direct contact with the underside of the structural roof sheathing.
   5.2. Air-permeable insulation only. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.5 for condensation control.
   5.3. Air-impermeable and air-permeable insulation. The *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the *air-impermeable insulation.*
   5.4. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Reason: The term "attic" is already defined and the additional commentary not only adds confusion but is misleading because attics occur at locations other than the top story. The revision makes the first sentence consistent with the title of the section.
From the IRC: **"ATTIC.** The unfinished space between the ceiling assembly of the top *story* and the roof assembly."

Cost Impact: The code change proposal will not increase the cost of construction.

RB403-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R806.5-RB-DAVIDSON.doc

RB404 – 13
R806.5

Proponent: Joseph Lstiburek, Building Science Corporation, representing self (joe@buildingscience.com), Steven R Winkel, FAIA, PE, The Preview Group, Inc., representing The American Institute of Architects (swinkel@preview-group.com)

Delete and substitute as follows:

~~**R806.5 Unvented attic and unvented enclosed rafter assemblies.** Unvented *attic* assemblies (spaces between the ceiling joists of the top *story* and the roof rafters) and unvented enclosed rafter assemblies (spaces between ceilings that are applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members/rafters) shall be permitted if all the following conditions are met:~~

1. ~~The unvented *attic* space is completely contained within the *building thermal envelope.*~~
2. ~~No interior Class I vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed rafter assembly.~~
3. ~~Where wood shingles or shakes are used, a minimum 1/4- inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.~~
4. ~~In Climate Zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class III vapor retarder coating or covering in direct contact with the underside of the insulation.~~
5. ~~Either Items 5.1, 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.~~
    - ~~5.1. *Air-impermeable insulation* only. Insulation shall be applied in direct contact with the underside of the structural roof sheathing.~~
    - ~~5.2. Air-permeable insulation only. In addition to= the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.5 for condensation control.~~
    - ~~5.3. Air-impermeable and air-permeable insulation. The *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the *air-impermeable insulation.*~~
    - ~~5.4. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.~~

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented *attics* and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members /rafters, shall be permitted where all the following conditions are met:

1. The unvented *attic* space is completely within the *building thermal envelope*.
2. No interior Class I vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, a minimum 1/4 inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In climate zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall be located in accordance with the following:

5.1 Items 5.1.1, 5.1.2 , 5.1.3, or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

5.1.1 Where only *air-impermeable insulation* is provided, the *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing.

5.1.2. Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed per Section 5.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R values in in Table R806.5 for condensation control.

5.1.3. Where both *air-impermeable* and air-permeable *insulation* are provided the *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R values in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the *air-impermeable insulation.*

5.1.4 Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45 degrees F (7 degrees C). For calculation purposes, an interior air temperature of 68 degrees F (20 degrees C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

5.2 Where preformed insulation board is used as the *air-impermeable insulation* layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Reason: The changes to R806.5 are based on the Track A Final Action Hearing revisions to IBC Section 1203.3. These changes were made to coordinate insulation requirements for unvented attics between the IBC and the IRC. The original proposed changes to the IBC were based on the language from the 2012 IRC. In the course of the committee action and the Final Action Hearing the IBC language was cleaned up and now reads more clearly than the current 2012 IRC language. This proposed change is meant to align IRC and IBC provisions for similar conditions and to make use of the clearer new IBC language in the IRC.

Cost Impact: The code change proposal will not increase the cost of construction. Primarily editorial changes.

RB404-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R806.5-RB-LSTIBUREK-WINKEL.doc

RB405 – 13
Table R806.5

Proponent: Joseph Lstiburek, Building Science Corporation, representing self
(joe@buildingscience.com)

Revise as follows:

TABLE R806.5
INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION *R*-VALUE[a,b]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to but does not supersede the requirements in Section N1102.
b. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45 degrees F (7 degrees C). For calculation purposes, an interior air temperature of 68 degrees F (20 degrees C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

Reason: The R-values in the table are based on R-49 ceiling insulation in Climate Zones 4, 5, 6, 7 and 8 and R-38 insulation in Climate Zones 2 and 3. Not all roof assemblies have these ceiling insulation R-values. The footnote provides a calculation procedure to determine rigid board or air impermeable insulation R-values for roof assemblies that have different ceiling insulation R-values. Additionally, this footnote is consistent with similar language in the IBC Section 1203.3 providing alignment between the IRC and the IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB405-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R806.5-RB-LSTIBUREK.doc

RB406 – 13
R807.1

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

R807.1 Attic Access. ~~Buildings~~ Dwellings with concealed ~~combustible ceilings or roof construction~~ attics shall have an attic access opening to attic areas that ~~exceed 30 square feet and~~ have a vertical height of 30 inches or more. The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members.

The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) ~~and shall be located in a hallway or other readily accessible location~~. When located in a wall, the opening shall be a minimum of 22 inches wide by 30 inches high (559 mm wide by 762 mm high). When the access is located in a ceiling, minimum unobstructed headroom in the *attic* space shall be 30 inches (762 mm) at some point above the access measured vertically from the bottom of ceiling framing members. See Section M1305.1.3 for access requirements where mechanical *equipment* is located in *attics.*

Exception: An attic access is not required:

1. for attics above unconditioned space or
2. where the area of the attic is less than 300 square feet

Reason: The ICC Commentary for the IRC states: *The requirement for an attic access is predicated on the likelihood that during the life of the structure, access to an attic space for repair of piping, electrical and mechanical systems will be required.*

If this is true, then language in the section that states *"Buildings with combustible ceilings or roof construction shall have…."* is misleading because attics of non-combustible construction are just as likely to have piping, electrical and mechanical systems. The ***IBC*** makes no mention of combustibility in its attic access requirements. And, the mechanical code (M1305.1.3) already requires access for equipment in an attic. It is less obvious why access is need for piping or electrical systems that would never need service. So the purpose of the access is universally poorly understood.

If it is believed that access should be provided regardless of equipment, a more realistic approach would be to require access to any attic that contains concealed spaces and without regard to construction materials used. Furthermore, direction on the location of the access needs to be more useful. Currently the code says the access must be "in a hallway or other readily accessible location". There are a number of problems with this language. It leads one to believe that the access must be interior to the dwelling. Why couldn't the access be via a gable end hatch, through a knee wall, or via a garage attic? Eliminating the access within the dwelling solves a problem involving heat loss and air infiltration.

Another confusing component is that the term "readily accessible" is somewhat defined in the code as follows:

> *Ready Access (to). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel, door, or similar obstruction, and without requiring the use of portable access equipment.*

This poses another dilemma. It states that "ready access" may not require removal of a panel or movement of a door and must be accessed by means other than a portable device such as a ladder. So interpreted literally would mean that the access could not be in a room accessed by a door, swinging or sliding, and it must be accessed by means of a stair or fixed ladder. This is not the norm practiced in the industry.

Then there is the issue of providing access to spaces as small as 30 square feet which means even some small porch attics would require access. 30 square feet is just too small an area to regulate.

The IBC provides no direction on where the access must be. It only requires that there be one and stipulates the size.
To alleviate these issues, this proposal would require an access for all attics in dwellings that have concealed spaces, would not dictate where the access must be consistent with the IBC, and provides two exceptions where access would typically serve no useful purpose such as a garage attic or areas with very small attics.

It should also be remembered that an access can be provided even if the code does not require one and that creating an opening in a ceiling or wall that does not contain an opening is a very simple operation.

Cost Impact: The code change proposal will not increase the cost of construction.

RB406-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R807.1-RB-DAVIDSON.doc

RB407 – 13
R807.1

Proponent: Charles S. Bajnai, Chesterfield County, VA, representing ICC Building Code Action Committee and Virginia Building and Code Officials Association (bajnaic@chesterfield.gov)

Revise as follows:

R807.1 Attic access. Buildings with combustible ceiling or roof construction shall have an *attic* access opening to *attic* areas ~~that exceed 30 square feet (2.8 m2) and~~ that have a vertical height of 30 inches (762 mm) or greater over an area of not less than 30 square feet. The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members.

The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other readily accessible location. When located in a wall, the opening shall be a minimum of 22 inches wide by 30 inches high (559 mm wide by 762 mm high). When the access is located in a ceiling, minimum unobstructed headroom in the *attic* space shall be 30 inches (762 mm) at some point above the access measured vertically from the bottom of ceiling framing members. See Section M1305.1.3 for access requirements where mechanical *equipment* is located in *attics.*

Reason: This proposal is submitted by the ICC Building Code Action Committee (BCAC) The BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held 6 open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: http://www.iccsafe.org/cs/BCAC/Pages/default.aspx.

The primary reason for this change is to clarify that the volume of space required for an attic access should be measured as the actual usable space. The clearance should be measured to collar ties, insulation curbs, or other permanent obstructions, not always to the ceiling or roof framing members. The revision of the text describing the 30 square feet is an editorial revision and is not intended to change the requirement, but make it more understandable.

Cost Impact: The code change proposal will not increase the cost of construction. It may decrease the cost.

RB407-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R807.1-RB-BAJNAI-BCAC.doc

RB408 – 13
R902.1

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R902.1 Roofing covering materials. Roofs shall be covered with materials as set forth in Sections R904 and R905. Class A, B or C roofing shall be installed in areas designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a lot line. Classes A, B and C roofing required by this section to be listed shall be tested in accordance with UL 790 or ASTM E 108.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry and exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile, or slate installed on noncombustible decks.
3. Class A roof assemblies include minimum 16 oz/ft^2 copper sheets installed over combustible decks.
4. <u>Class A roof assemblies include slate installed over underlayment over combustible decks.</u>

Reason: In IRC 2009 (and similarly in IBC 2009), the historic exemptions from fire testing for certain roof covering types, including copper sheets and slate, over combustible roof decks were amended to require ASTM E 108 or UL 790 fire testing. At the time, a lack of adequate fire test data was cited as the reason for this change.

In IRC 2012, Exception 3 was added based upon fire testing conducted by the Copper Development Association.

The National Roofing Contractors Association and the National Slate Association have conducted fire tests at Underwriters Laboratories, Inc. (UL) that documents slate installed over an underlayment over a combustible deck meets the requirements of UL 790 Class A. This testing substantiates the addition of Exception 4 as a Class A roof assembly.

This same code change proposal was submitted for the International Building Code as S20-12 in Group A and was Approved as Submitted.

A copy of this test report has been submitted with this code change proposal; additional copies are available by contacting the proponent.

Cost Impact: This code change proposal will not increase the cost of construction.

RB408-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R902.1-RB-GRAHAM.doc

RB409 – 13
R903.5 (NEW)

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Add new text as follows:

<u>**R903.5 Attic ventilation.** Intake and exhaust vents shall be provided in accordance with Section R806 and the roof covering manufacturer's installation instruction.</u>

Reason: This code change proposal is intended to coordinate the requirements for attic ventilation in Section R806 with roof covering manufacturer's requirements. In many cases, roof covering manufacturers' installation instructions specifically require attic ventilation.

Cost Impact: This code change proposal will not increase the cost of construction.

RB409-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R903.5 (NEW)-RB-GRAHAM.doc

RB410 – 13
R904.2

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Delete without substitution as follows:

~~**R904.2 Compatibility of materials.** Roof assemblies shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.~~

Reason: This code change proposal is intended to better facilitate compliance and ease enforcement of the Code relating to roof assemblies.

Specific criteria are not provided in the Code for determining roofing materials' compatibility or incompatibility. Material compatibility is best determined by material manufacturers and should be explained or restricted in manufacturers' installation instructions, which are already provided for in Section R904.

Deleting this section relieves the building official from needing to make determinations of materials' compatibility or incompatibility without specific criteria.

Cost Impact: This code change proposal will not increase the cost of construction.

RB410-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R904.2-RB-GRAHAM.doc

RB411 – 13
R904.3, R904.3.1 (NEW)

Proponent: Michael D. Fischer, Kellen Company, representing the Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

R904.3 Material specifications and physical characteristics. Roof covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards ~~or where materials are of questionable suitability,~~ testing by an *approved* testing agency shall be required by the *building official* to ~~determine the character, quality and limitations of application of the materials~~ <u>demonstrate compliance with the intent of this code</u>.

<u>**R904.3.1 Underlayment.** Underlayment materials shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D 226, D 1970, D4869 and D 6757 shall bear a label indicating compliance to the standard and indicating the appropriate performance grade.</u>

Reason: The roofing requirements include vague language regarding an additional testing requirement for roof coverings that might be required by the building official. This existing text provides a standard inconsistent with the Chapter 1 option for alternate means and methods. This proposal clarifies that should the code official require such testing, it must demonstrate compliance with the intent of the code. The section also fails to provide similar guidance for underlayment materials; the proposal adds that reference and institutes a provision requiring labeling to the appropriate ASTM standards for underlayment- including the required product performance grade. With the increased reliance on underlayment materials to provide additional weather protection when the roof covering is damaged by wind storms or other events, the labeling requirement provides assurance that the product will perform as intended and will comply with the referenced standards.

Cost Impact: The code change proposal will increase the cost of construction.

RB411-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R904.3-RB-FISCHER.doc

RB412 – 13
R904.3

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R904.3 Material specifications and physical characteristics. Roof covering materials shall conform to the applicable standards listed in this chapter. ~~In the absence of applicable standards or where materials are of questionable suitability, testing by an *approved* testing agency shall be required by the *building official* to determine the character, quality and limitations of application of the materials.~~

Reason: This code change is intended to clarify the code's intent relating to the use of roofing materials that do not specifically conform to the requirements of this Chapter.

It can be interpreted as currently written the second sentence of Section R904.3 may conflict somewhat with Section R104.11-Alternative Materials, Design and Methods of Construction and Equipment. Deleting this sentence avoids this possible conflict and allows Section R104.11 to apply.

This same code change proposal was submitted for the International Building Code as S27-12 in Group A and was Approved as Modified. This code change proposal reflects the modification.

Cost Impact: This code change proposal will not increase the cost of construction.

RB412-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R904.3-RB-GRAHAM.doc

RB413 – 13
R905.1

Proponent: W. Harvey Cappel, P.E., Racelectric Engineering F-1525, representing self (hcappel@aol.com)

Revise as follows:

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. Unless ~~otherwise specified in this section,~~ specifically waived by a listed exception in the appropriate code section, roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

Reason: The term "otherwise specified" without a definition basically means "anything specified" which makes this Section R905.1 meaningless and basically void. The original intent here is to require roof coverings to be installed to resist specific wind loads. With this undefined "otherwise specified" loophole the intent of R905.1 is cancelled. We want roof coverings to be installed to resist the wind loads so let's be clear about what we want.

Note: I will submit other changes to related sections of this code to completely correct this problem.

Cost Impact: The code change proposal will not increase the cost of construction.

RB413-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.1-RB-CAPPEL.doc

RB414 – 13
R905.2.3, R905.4.3, R905.5.3, R905.6.3, R905.7.3, R905.8.3

Proponent: Michael D. Fischer, Kellen Company, representing the Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

R905.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226 Type I or II, ASTM D 4869 Type I,II, III or IV, or ASTM D 6757.

R905.4.3 Underlayment. Underlayment shall comply with ASTM D 226~~,~~ Type I or ~~Type~~ II, ASTM D 4869, Type I, ~~or Type~~ II, III or IV, or ASTM D 1970. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

R905.5.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or II, or ASTM D 4869, Type I, ~~or~~ II, III or IV.

R905.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or II, or ASTM D 4869, Type I, ~~or~~ II, III or IV. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

R905.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or II, or ASTM D 4869, Type I, ~~or~~ II, III or IV.

R905.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or II, or ASTM D 4869, Type I, ~~or~~ II, III or IV.

Reason: The current code requirements for certain underlayments do not accurately capture all available material grades. As an example, asphalt shingles in high-wind areas are required to have an ASTM D226 Type II underlayment, but the code does not allow that material to be used outside of the high wind areas. This proposal broadens the available and applicable performance grades for underlayment materials, and is largely editorial.

Cost Impact: The code change proposal will not increase the cost of construction.

RB414-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.3-RB-FISCHER.doc

RB415 – 13
R905.2.3, R905.4.3, R905.5.3, R905.6.3, R905.7.3, R905.8.3, R905.10.5

Proponent: Mark Zehnal, Florida Roofing, Sheet Metal and Air Conditioning Contractors Association Inc. (FRSA)

Revise as follows:

R905.2.3 Underlayment. Unless otherwise noted, required underlayment shall ~~conform to~~ comply with ASTM D 226 Type I or Type II, ASTM D 4869, Type ~~I~~ II or Type IV, or ASTM D 6757. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

R905.4.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type ~~I~~ II or Type ~~II~~ IV or ASTM D 1970 or ASTM D 6757. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

R905.5.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type ~~I~~ II or Type ~~II~~ IV or ASTM D 1970 or ASTM D 6757.

R905.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type ~~I~~ II or Type ~~II~~ IV or ASTM D 1970 or ASTM D 6757. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

R905.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type ~~I~~ II or Type ~~II~~ IV.

R905.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type ~~I~~ II or Type ~~II~~ IV.

R905.10.5 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 1970 or ASTM D 6757. Underlayment shall be installed in accordance with the manufacturer's installation instructions.

Reason: Strengthen and unify the code by including manufacturer approved options for minimum types of underlayment.

Cost Impact: The code change proposal may increase the cost of construction.

RB415-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.3-RB-ZEHNAL.doc

RB416 – 13
R905.6.3

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type ~~I~~ II, or ASTM D4869, Type ~~I or II~~ III or IV. ~~Underlayment shall be installed in accordance with the manufacturer's installation instructions~~.

Reason: This code change proposal is intended to update the Code's minimum requirement for underlayment used with slate roof systems.

Both *The NRCA Roofing Manual* and the National Slate Association's *Slate Roofs Design and Installation Manual* recommend a minimum No. 30 underlayment be used with slate roofs. A No. 30 designation is consistent with underlayment products designated as ASTM D226, Type II or ASTM D 4869, Type III or Type IV. Use of these type classes in the Code is necessary to differentiate products from lighter-weight No. 15 underlayment products.

This same code change proposal was submitted for the International Building Code as S40-12 in Group A and was Approved as Submitted.

Removal of the second sentence (i.e., "Underlayment shall be installed…") is intended to remove redundant requirements. Compliance with the manufacturer's installation instruction is already required in Section R904.1.

Cost Impact: The code change proposal will not increase the cost of construction.

RB416-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.6.3-RB-GRAHAM.doc

RB417 – 13
R905.2.4

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.2.4 Asphalt shingles. Asphalt shingles shall comply with ~~ASTM D 225 or~~ ASTM D 3462.

Reason: This code change proposal is intended to remove ASTM D 225 (organic felt-reinforced asphalt shingles) as an acceptable product standard in the Code.

Organic felt-reinforced asphalt shingles are no longer manufactured in North America and ASTM International has withdrawn ASTM D 225.

Cost Impact: This code change proposal will not increase the cost of construction.

RB417-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.4-RB-GRAHAM.doc

RB418 – 13

R905.2.4.1, Table R905.2.4.1, Table R905.2.4.1(1), Table R905.2.4.1(2), R905.2.7.2, R905.3.3.3, R905.3.7, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org)

Revise as follows:

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1~~(1)~~ for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification in Table R905.2.4.1~~(1)~~.

> **Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification in Table R905.2.4.1~~(2)~~.

~~TABLE R905.2.4.1(1)~~
~~CLASSIFICATION OF ASPHALT ROOF SHINGLES PER ASTM D 7158~~

~~MAXIMUM BASIC WIND SPEED FROM FIGURE 301.2(4)A (mph)~~	~~CLASSIFICATION REQUIREMENT~~
~~85~~	~~D, G or H~~
~~90~~	~~D, G or H~~
~~100~~	~~G or H~~
~~110~~	~~G or H~~
~~120~~	~~G or H~~
~~130~~	~~H~~
~~140~~	~~H~~
~~150~~	~~H~~

~~For SI: 1 mile per hour = 0.447 m/s.~~

~~TABLE R905.2.4.1(2)~~
~~CLASSIFICATION OF ASPHALT SHINGLES PER ASTM D 3161~~

~~MAXIMUM BASIC WIND SPEED FROM FIGURE 301.2(4)A (mph)~~	~~CLASSIFICATION REQUIREMENT~~
~~85~~	~~A, D or F~~
~~90~~	~~A, D or F~~
~~100~~	~~A, D or F~~
~~110~~	~~F~~
~~120~~	~~F~~
~~130~~	~~F~~
~~140~~	~~F~~

~~150~~	~~F~~

~~For SI: 1 mile per hour = 0.447 m/s.~~

TABLE R905.2.4.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ULT} FROM FIGURE R301.2(4)A	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3	ASTM D 7158~~[A]~~ SHINGLE CLASSIFICATION	ASTM D 3161 SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mph = 0.447 m/s.
a. The standard calculations contained in ASTM D 7158 assume exposure category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.3.3.3 Underlayment and high winds. Underlayment applied in areas subject to high wind [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4-inch (19 mm) into the roof sheathing.

R905.3.7 Application. Tile shall be applied in accordance with this chapter and the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.

4. Type of tile being installed.

Clay and concrete roof tiles shall be fastened in accordance with this section and the manufacturer's installation instructions. Perimeter tiles shall be fastened with a minimum of one fastener per tile. Tiles with installed weight less than 9 pounds per square foot (0.4 kg/m2) require a minimum of one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer's installation instructions where applied in areas where the wind speed exceeds ~~100~~ 130 miles per hour (~~45~~ 58 m/s) and on buildings where the roof is located more than 40 feet (12 192 mm) above grade. In areas subject to snow, a minimum of two fasteners per tile is required. In all other areas, clay and concrete roof tiles shall be attached in accordance with Table R905.3.7.

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.7.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all Head laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds ~~110~~ 140 mph (~~49~~ 63 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds ~~120~~ 150 mph (~~54~~ 67 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates the Chapter 9 provisions for roof coverings, including asphalt shingle classifications and triggers for high-wind roof covering and underlayment installation requirements. A similar table to new table R905.2.4.1 was proposed by ARMA and approved for the 2015 IBC.

Cost Impact: The code change proposal will not increase the cost of construction.

RB418-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.4.1-RB-EHRLICH.doc

RB419 – 13
R905.2.4.1, Table R905.2.4.1 (NEW), Table R905.2.4.1(1), Table R905.2.4.1(2)

Proponent: Michael D. Fischer, Kellen Company, representing the Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1~~(1)~~ for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a *label* to indicate compliance with ASTM D 7158 and the required classification in Table R905.2.4.1~~(1)~~.

> **Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and *labeled* to indicate compliance with ASTM D 3161 and the required classification in Table R905.2.4.1~~(2)~~.

~~TABLE R905.2.4.1(1)~~
~~CLASSIFICATION OF ASPHALT ROOF SHINGLES PER ASTM D 7158~~

~~MAXIMUM BASIC WIND SPEED FROM FIGURE 301.2(4)A (mph)~~	~~CLASSIFICATION REQUIREMENT~~
~~85~~	~~D, G or H~~
~~90~~	~~D, G or H~~
~~100~~	~~G or H~~
~~110~~	~~G or H~~
~~120~~	~~G or H~~
~~130~~	~~H~~
~~140~~	~~H~~
~~150~~	~~H~~

~~For SI: 1 mile per hour = 0.447 m/s.~~

TABLE R905.2.4.1
CLASSIFICATION OF ASPHALT SHINGLES

Maximum Basic Wind Speed from Figure R301.1(4)A or ASCE-7	Vasd	ASTM D7158	ASTM D 3161
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	160	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mph = 0.447 m/s.

~~**TABLE R905.2.4.1(2)**~~
~~**CLASSIFICATION OF ASPHALT SHINGLES PER ASTM D 3161**~~

~~**MAXIMUM BASIC WIND SPEED FROM FIGURE 301.2(4)A (mph)**~~	~~**CLASSIFICATION REQUIREMENT**~~
~~85~~	~~A, D or F~~
~~90~~	~~A, D or F~~
~~100~~	~~A, D or F~~
~~110~~	~~F~~
~~120~~	~~F~~
~~130~~	~~F~~
~~140~~	~~F~~
~~150~~	~~F~~

~~For SI: 1 mile per hour = 0.447 m/s.~~

Reason: The proposal reflects changes to ASCE-7-10 that modify the basic wind speeds. The change will require correlation to ensure appropriate product selection of asphalt shingles evaluated to the referenced standards.

Cost Impact: The code change proposal will not increase the cost of construction.

RB419-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.4.1-RB-FISCHER.doc

RB420 – 13
R905.2.4.1

Proponent: W. Harvey Cappel, P.E., Racelectric Engineering F-1525, representing self (hcappel@aol.com)

Revise as follows:

R905.2.4.1 Wind resistance of asphalt shingle~~s~~ adhesive strips. Asphalt shingles shall be tested for wind resistance of the adhesive strips in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1(1) for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a *label* to indicate compliance with ASTM D 7158 and the required classification in Table R905.2.4.1(1).

> **Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and *labeled* to indicate compliance with ASTM D 3161 and the required classification in Table R905.2.4.1(2).

Reason: The referenced test standards test the adhesive and its resistance to tab failure due to wind loads (test simulated) on the upwind side of the roof. These tests do not test fasteners or the resistances of fasteners to withdrawal from the wood deck or shingle pull thru. Mr. Mike Noone, Chairman of ASTM Subcommittee D08-02 (the authors of ASTM D 3161 and similar test codes) will confirm this. The problem with the current wording is that it is misleading causing some to believe that use of the manufactures' nail standard during this test is a test of the nails and therefore the standard nailing required, for these shingles, on any roof for winds up to the test standard wind speeds. This is not true. Per Section R905.1 the fasteners attachment must be designed to resist the component and cladding loads specified in Table R301.2(2) adjusted for height and exposure in accordance with Table R301.2(3). Shingle attachment fasteners are not tested nor do they need to be. Sufficient data is already available to Engineers for the design of fastener systems.

Note: I will submit other changes to related sections of this code to completely correct this problem.

Cost Impact: This code change proposal will not increase the cost of construction. The only impact this code change proposal will have on cost is to those that have been wrongly interpreting the intent of the Code. In this case the cost of only a few more nails per shingle will be insignificant especially as compared to the cost of a failed shingle system cause by inadequate nailing.

RB420-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.4.1-RB-CAPPEL.doc

RB421 – 13
R905.2.5

Proponent: W. Harvey Cappel, P.E., Racelectric Engineering F-1525, representing self (hcappel@aol.com)

Revise as follows:

R905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (3 mm)] shank with a minimum 3/8-inch (10 mm) diameter head, ASTM F 1667, of a length to penetrate through the roofing materials and ~~a minimum of 3/4 inch (19 mm) into the roof sheathing. Where the roof sheathing is less than 3/4 inch (19 mm) thick, the fasteners shall penetrate through the sheathing~~ <u>penetrate through the minimum required roof sheathing or penetrate to an equivalent embedment into the thicker than minimum required roof sheathing</u>. Fasteners shall comply with ASTM F 1667.

Reason: The current Section wording is ambiguous. It implies an either or standard with the in-between not in compliance with the Code. This is ridiculous. If a 3/8 inch penetration (typical for minimum deck thickness) is in compliance with the Code then all greater penetrations and embedment's up to and including the other Code required ¾ inch penetration are also in compliance with the Code. The problem with this incorrect wording is that it is being used as evidence of non-compliance, which is senseless.

Note: I will submit other changes to related sections of this code to completely correct this problem.

Cost Impact: This code change proposal will not increase the cost of construction. There will be no cost impact related to this proposed Code change; only less confusion and potentially a cost savings.

RB421-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.5-RB-CAPPEL.doc

RB422 – 13
R905.2.5

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (3 mm)] shank with a minimum 3/8-inch-diameter (10 mm) head, <u>complying with</u> ASTM F 1667, of a length to penetrate through the roofing materials and a minimum of ¾ inch (19 mm) into the roof sheathing. Where the roof sheathing is less than ¾ inch (19 mm) thick, the fasteners shall penetrate through the sheathing. ~~Fasteners shall comply with F 1667.~~

Reason: This code change proposal is intended to remove a redundant requirement with Section R905.2.5.

Cost Impact: This code change proposal will not increase the cost of construction.

RB422-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.5-RB-GRAHAM.doc

RB423 – 13
R905.2.6

Proponent: Andrew Herseth, US Dept of Homeland Security, representing Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. <u>Shingles applied where wind design is required by in accordance with Section R301.2.1.1, shall be fastened with not less than six fasteners per strip shingle.</u> Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), 175-percent slope), shingles shall be installed as required by the manufacturer.

Reason: Use of six fasteners to attach strip shingles in high wind areas has long been recognized. For example:

- National Bureau of Standards *Report BMS70 (*April 10, 1941) *Asphalt-Prepared Roll Roofings and Shingles* states "For severe conditions, such as prevailing high winds, the shingles will be fastened more securely" if six nails per shingle are used.
- Section 3.2 of the current edition (2009) of *The NRCA Roofing Manual: Steep-slope Roof Systems* states “For areas considered to be high-wind regions, six-nail attachment of asphalt strip shingles may be required by the applicable building code. For these situations, manufacturers generally specify full-width shingles be fastened with six nails.”
- The current edition (2006) of the Asphalt Manufacturers Association (ARMA) *Asphalt Roofing Residential Manual* states “for areas considered to be high wind regions from historical experience or by local building code authorities, the following six nail method should be considered:”
- Shingle manufacturer’s instructions regarding fastening in high wind areas vary. One manufacturer states “For areas where local knowledge indicates exposure to high winds may occur, shingles must be applied with 6 nails …”.

Use of four nails per shingle rather than six was frequently observed on damaged roofs by FEMA Mitigation Assessment Teams (MAT) deployed after Hurricanes Charley (FL, 2004), Ivan (2004), Katrina (LA and MS, 2005) and Ike (TX, 2008). All of the damaged roofs were located in areas where the basic wind speed is 110 mph or higher [per Figure R301.2(4)A]. MAT observations are documented in FEMA publications 488, 489, 549 and P-757.

This code change proposal seeks to explicitly require the use of six fasteners per strip shingle in high wind areas, and it defines “high wind”. This proposal eliminates ambiguity currently found in industry publications and manufacturers’ literature, and it facilitates code enforcement.

Note: There are two “best practices” publications that recommend use of six fasteners at speeds lower than that given in this proposal. However, as a code minimum, areas with a basic wind speed greater than 110 mph is proposed, which is consistent with the shaded area in Figure R301.2(4)B, which stipulates where wind design is required.

- FEMA’s Coastal Construction Manual (P-55, 2011) recommends six fasteners per strip shingle where the basic wind speed is greater than 90 mph [per Figure R301.2(4)A]
- *Fortified For Safer Living Standards* (2008), published by the Insurance Institute for Business and Home Safety (IBHS) requires the use of six nails per strip shingle where the basic wind speed is greater than 100 mph [per Figure R301.2(4)A].

Cost Impact: The code change proposal will not increase the cost of construction because if current guidance is properly followed, shingles would be attached with six fasteners.

RB423-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.6-RB-HERSETH-OVERCASH.doc

RB424 – 13
R905.2.6

Proponent: W. Harvey Cappel, P.E., Racelectric Engineering F-1525, representing self (hcappel@aol.com)

Revise as follows:

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175 percent slope), <u>or where the basic wind speed is equal to or exceeds 100 mph</u> shingles shall be installed as required by the manufacturer<u>, but with not less than six nails per shingle and as required to comply with Section R905.1</u>.

Reason: The current Code is being misinterpreted (mainly because of a misunderstanding of the ASTM D 3161 test (it only tests adhesives) requirement for high wind areas) regarding the fastening requirements to resist wind loads. This proposed change will help reinforce the known requirement that additional fasteners are required in high wind areas. The shingle manufacturers cannot be relied on for this requirement since they cannot and do not take responsibility for fastening design or fastening installation in high wind areas. There, wind related, limit of warranty and responsibility typically stops with assurance against manufacturer's defects and compliance with one of the ASTM adhesive tests standards. Knowing that four nails per shingle are typically inadequate in high wind areas here is opportunity to set a minimum standard for high wind areas. The extreme number of shingle failures as a result of recent hurricanes Rita and Ike with wind speeds well below the typical coastal design standards should be sufficient motivation to make a change in our shingle installation Codes. What we have in force now, (basically four nails per shingle everywhere) is not working.

Note: I will submit other changes to related sections of this code to completely correct this problem.

Cost Impact: This code change proposal will not increase the cost of construction. There will be no cost impact (as compared to the original intent of the Code) related to this proposed Code change. Even if this change causes some construction projects to use six nails per shingle instead of the incorrect four nails per shingle, the additional cost will be minimal, especially as compared to the cost of an inadequate and failed shingle installation.

RB424-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.6-RB-CAPPEL.doc

RB425 – 13
R905.2.7.1

Proponent: Bill McHugh, Chicago Roofing Contractors Association (bill@crca.org)

Revise as follows:

R905.2.7.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exceptions:

1. Detached *accessory structures* that contain no *conditioned floor area*.
2. Roofs with slope equal to or greater than 8 units vertical in 12 units horizontal, the ice barrier shall be applied not less than 36 inches (914 mm) measured along the roof slope from the eave edge of the building.

Reason: In steep slope applications in climates where ice forms at the eave edge of roofs, ice melts due to heat from below, then freezes where the water meets roof surfaces that are over unheated areas, making a buildup of ice. This buildup becomes a 'dam' that backs water up under the roof covering and underlayment leaking into the building.

The purpose of this proposal is to bring the Code into alignment with the practical application of the ice barrier underlayment products in the field. Since gravity stops water from backing up very far on super steep slopes greater than 8" in 12" there needs to be a limit to the amount of ice barrier underlayment applied.

On very steep sloped roofs, the ice dams will still occur. However, buildup of ice cannot build far beyond the ball that forms at the gutter edge on slopes greater than 8" in 12" due to the slope. Secondly, the water will not defy gravity and move very far upward, when the physics of the application are that the water will drip over the dam first.

For very high sloped roofs where the vertical surface never intersects the heated wall, complete coverage of underlayment is needed. In short, the way the current code is written, ice barrier material may be needed on the complete 'high sloped' roof deck rather than protect just the eave edges and 3' up slope. The intent of 3' of underlayment applied past the warm vertical wall intersection up slope is met with this change.

Through clarifying this requirement with the second exception, the intent of the code is met while not burdening the building official with a variance request on a very small cost item.

Cost Impact: The code change proposal will not increase the cost of construction. It decreases the cost.

RB425-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.1 #1-RB-MCHUGH.doc

RB426 – 13
R905.2.7.1

Proponent: Bill McHugh, Chicago Roofing Contractors Association (bill@crca.org)

Revise as follows:

R905.2.7.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend <u>2 inches (51 mm) down the fascia and under the drip edge and</u> from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Reason: In steep slope applications in climates where ice forms at the eave edge of roofs, ice melts due to heat from below, then freezes where the water meets roof surfaces that are over unheated areas. The frozen water builds, resulting in a dam that blocks water flow of water that continues to flow due to heat. That 'dam' blocks water flow causing water to stand on the roof, even when it has slope. The result is that the 'dam' buildup forces water upslope under roof covering causing leaks.

Studies show that roof recover applications typically fail at flashings on all roof slopes. The roof edge flashings are most susceptible to leaks from water backing up under the underlayment and roof covering because it freezes at the eave edge first causing water back up the slope of the structure.

According to CRCA roofing contractors, if the code required underlayment is applied to the top of the metal drip edge, a seal may be difficult and the water will leak into the structure where a void exists. Voids form due to joints in the metal, uneven or dirty surfaces before application of the underlayment. Further, if underlayment is applied to these flashings, water can be pushed by the ice dam working on the 'back water lap' up slope possibly causing leaks. The leak(s) may be difficult to detect in the concealed space location.

In new construction, tear off and roof replacement situations, the roofing underlayment is easily installed before the drip edges at the eave edge. In reroofing and roof-recover applications, it does mean removing edge metal and reapplication.

We believe this will provide needed guidance to both new construction, reroofing, roof recover and roof replacements providing better service to the residential building owner.

Cost Impact: This may slightly increase cost of reroofing, roof recover. There is a very small increase in cost for new construction.

RB426-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.1 #2-RB-MCHUGH.doc

RB427 – 13
R905.3.3.1, R905.3.3.2, R905.3.3.3, R905.3.4.1 (NEW)

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

~~R905.3.3.1 Low slope roofs~~ R905.3.4 Underlayment Application. For roof slopes from two and one-half units vertical in 12 units horizontal (2½:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be ~~a minimum of~~ two layers ~~underlayment~~ applied ~~as follows:~~ in the following manner. ~~1. Starting at the eave,~~ Apply a 19-inch (483 mm) strip of underlayment ~~shall be applied~~ parallel ~~with~~ to and starting at the eaves, ~~and~~ fastened sufficiently to hold in place. ~~2.~~ Starting at the eave, apply 36-inch-wide (914 mm) ~~strips~~ sheets of underlayment ~~felt shall be applied,~~ over-lapping successive sheets 19 inches (483 mm), and fastened sufficiently to hold in place.

~~R905.3.3.2 High slope roofs.~~ For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be ~~a minimum of~~ one layer ~~of underlayment felt~~ applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eaves and lapped 2 inches (51 mm), fastened sufficiently to hold in place. End laps shall be offset by 6 feet (1829 mm).

R905.3.4.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

> **Exception:** Detached *accessory structures* that contain no *conditioned floor area*.

~~R905.3.3.3~~ R905.3.4.2 Underlayment and high winds. Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$-inch (19 mm) into the roof sheathing.

> **Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

Reason: This code change proposal is intended to clarify the code's requirements regarding underlayment for clay and concrete tile roof systems.

As currently written, the underlayment requirements for clay and concrete tile roof systems are formatted differently and are somewhat more confusing than the similar underlayment requirements for other steep-slope roof system types. This code change proposal reformats Section R905.3.3.1-Low Slope Roofs, Section R905.3.3.2-High Slope Roofs and Section R905.3.3.3-Underlayment and High Winds into a clearer, more concise format similar to that used in the Code for asphalt shingles.

Only two technical changes have been incorporated into this code change proposal: 1) The addition of "End laps shall be offset by 6 feet (1829 mm)." which is included the underlayment requirements for asphalt shingles. 2) The addition of specific ice barrier membrane requirements (new Section R905.3.4.1), which are already included for other steep-slope roof system types, but had apparently been omitted for clay and concrete tile roof systems.

Cost Impact: This code change proposal will not increase the cost of construction.

RB427-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.3.3.1-RB-GRAHAM.doc

RB428 – 13
R905.2.3, R905.2.7.2, R905.3.3, R905.4.3, R905.4.3.2, R905.5.3, R905.5.3.2, R905.6.3, R905.6.3.2, R905.7.3, R905.7.3.2, R905.8.3, R905.8.3.2

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ~~ASTM D 226 Type I,~~ ASTM D 4869 Type I, or ASTM D 6757.

Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II,~~ ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ~~ASTM D 226 Type II;~~ ASTM D 2626 Type I; or ASTM D 6380 Class M mineral surfaced roll roofing.

R905.4.3 Underlayment. Underlayment shall comply with ~~ASTM D 226, Type I or Type II,~~ ASTM D 4869, Type I or Type II, or ASTM D 1970. ~~Underlayment shall be installed in accordance with the manufacturer's installation instructions.~~

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II,~~ ASTM D 4869 Type IV~~, or ASTM D 1970~~. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.5.3 Underlayment. Underlayment shall comply with ~~ASTM D 226, Type I or~~ ASTM D 4869, Type I or II.

R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II or~~ ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.6.3 Underlayment. Underlayment shall comply with ~~ASTM D 226, Type I, or~~ ASTM D 4869, Type I or II. ~~Underlayment shall be installed in accordance with the manufacturer's installation instructions.~~

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II or~~ ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.7.3 Underlayment. Underlayment shall comply with ~~ASTM D 226, Type I or~~ ASTM D 4869, Type I or II.

R905.7.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II or~~ ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all Head laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.8.3 Underlayment. Underlayment shall comply with ~~ASTM D 226, Type I or~~ ASTM D 4869, Type I or II.

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ~~ASTM D 226 Type II or~~ ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

Reason: This code change proposal is intended to remove roofing felt-type products complying with ASTM D 226 from being considered as underlayment for steep-slope roof assemblies.

While ASTM D 226 products have previously been sometimes considered appropriate for use as underlayment, this is no longer the case. The scope of ASTM D 226 indicates the product is intended to be used as a ply sheet for built-up roof systems (such as in Section R905.9) or in membrane waterproofing systems. Use of this type of product as a steep-slope underlayment is clearly outside of the scope of the standard.

ASTM D4869, Type III and Type IV products have physical properties and dimensions and masses that are identical to ASTM D 226 Type I and Type II, respectively. However, ASTM D4869 also includes a resistance of the material to liquid water (a "water spray test") that is an important property for steep-slope underlayment products. ASTM D 226 does not include such a water spray test.

Also, in Section R905.4.3.2, reference to ASTM D 1970 is removed. Adhered underlayment does not require attachment. This is already addressed in the Exception to Section R905.4.3.

The statement "Underlayment shall be installed…" is also being deleted from Section R905.4.3 and Section R905.6.3 because it is redundant; this requirement is already provided in Section R904.1

Cost Impact: The code change proposal will not increase the cost of construction.

RB428-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.2-RB-GRAHAM.doc

RB429 – 13

R905.2.7.2, R905.3.3.3, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: John Kurtz, International Staple, Nail & Tool Association (isanta@ameritech.net)

Revise as follows:

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.3.3.3 Underlayment and high winds. Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ <u>Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.</u>

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ <u>Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.</u>

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.
Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102

mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.7.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all Head laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). Cap-nail shank shall be a minimum of 12 gauge (0.105 inches). Staple gage shall be a minimum 21 gage. Cap-nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

Reason: The IRC requirement for cap nails for attachment of roof covering underlayment in high-wind areas does not reflect commercially available cap staples successfully used in roofing material application. This proposal expands fastener to include cap staples based on tests indicating underlayment tears before proposed cap staples fail. Cap staple bearing area on underlayment is same as for cap nail - being determined by cap diameter.

Tests were conducted with ASTM D 4869 Type IV underlayment ("30 pound"). That underlayment is at high end of the thickness and toughness range of code-required underlayment - a "worst-case test" for the cap staple.

Test procedure and results accompany this proposal. (below)

Report on Testing
July 2012

Testing was performed by Stanley Black & Decker at the request of International Staple, Nail and Tool Association (ISANTA.)

Reference Standards

State of Florida

- Testing Application Standards (TAS) published in the State of Florida Building Code, 2007 for High Velocity Hurricane Zone (HVHZ) product approval testing.
- TAS 111(B)-95, Test Procedure for Edge Metal Pull-off Performance.
- TAS 117(C)-95, Test Procedure for Dynamic Pull-off Performance of Roofing Nail Heads or Fasteners with Bearing Plates.
- TAS 117(A)-95, Test Procedure for Withdrawal Resistance Testing of Mechanical Fasteners Used in Roof System Assemblies.
- TAS 117(B)-95, test Procedure for Dynamic Pull-through Performance of Roofing Membranes over Fastener Heads or Fasteners with Metal Bearing Plates.

ASTM Standards

- D1037, Standard Test Methods for Evaluating Properties of Wood-base fiber and Particle Panel Materials, Nail head Pull-through Test.
- D4869, Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
- D412, Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

Acceptance Criteria

- ICC-ES, AC188: Acceptance Criteria for Roof Underlayments. July 2007.

Materials

- Roofing paper, 30# (ASTM D 4869, Type IV)
- Sheathing material – 4-ply, 15/32-in. Southern Pine Plywood, cut in 2 by 2 in. squares
- Fasteners – Ring shank cap nails with nail shank diameters before threading of 0.083 inch and 0.105 inch. Cap staples, 18 gage and 21 gage.
- Caps – 1 inch diameter plastic caps

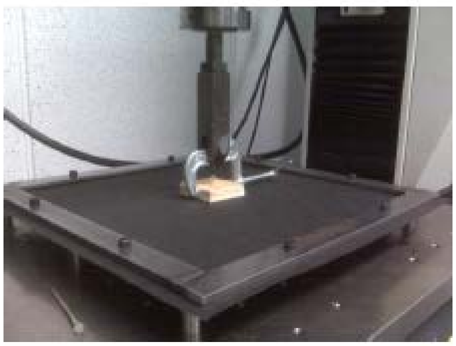
Method - The test method was designed to facilitate one of three potential failure modes: cap failure, fastener withdrawal, or cap pulling through underlayment. A 14x14-in. sheet of underlayment was cut from the roll. The cap-fastener was driven through the center of the underlayment sheet into a 2x2-in. block of sheathing material. The assembled test specimen was turned over so that the sheathing block was visible and the fastener head was down. The assembled specimen was secured in the test fixture base with the fastener centered below sheathing block clamping fixture. The sheathing block was clamped by the fixture attached to the traversing head of the test machine. The test specimen was loaded at constant displacement of 1 in./min. until failure. Load and displacement were monitored continuously during the test. Failure mode was observed and peak force was recorded as the failure load. Photographs provided.

Discussion - The test is intended to evaluate the functionality of the ISANTA proposal for adding additional commercially available cap fasteners for use on same spacing as IBC's 0.105" cap nail with a plastic or metal 1" diameter cap (as specified.) The underlayment is not wind qualified. However, AC188 evaluation includes a requirement for tensile strength by using one of three ASTM standards, for example, ASTM D412. The AC does not include a punch-through or pull-through evaluation. The minimum tensile strength criterion of AC188 is 20 lbf/in-width. The 20 lbf/in-width is a valuable benchmark in that it could also be used to assess the potential uplift resistance of the underlayment because that is controlled by tensile strength.

Tensile strength also appears to be a predictor of pull-through performance. The 1-in. caps generally pulled through the underlayment at approximately 32 lb. Some nonlinear behavior occurs at the start of the loading process, then the load-deflection diagram becomes linear, and as the load approaches the maximum a minor plastic region develops that reflects fiber separation and cap yielding. This was generally characteristic for all cap-fasteners.

Conclusions - From the testing and review of test standards and acceptance criteria, we can conclude that the underlayment minimum tensile strength is the controlling strength property of the system and it can be used as a reasonable approximation of the potential holding capacity of the cap-fasteners based on the cap diameter. Engineering analysis of the negative pressures on roof surfaces should provide reasonable estimates of expected forces that will be resisted by fasteners and can be used to establish fastening schedules that reflect the fastener holding capacity (pull-through or withdrawal) and tensile strength of the underlayment when loaded as a membrane between fasteners.

Test machine fixtures for the pull-through test.



Pull-through test in progress; (left) early in test; (right) nearing failure.

Metal cap with roofing nail fastener after the pull-through test. Observe the permanent deformation of the metal cap and the pull-through tears in the underlayment.

Results of Cap Fastener Testing with ASTM D 4869, Type IV Underlayment

Cap Fastener [1]	**Failure Load (pounds)**	**Number of Failures, by Failure Mode**		
		Fastener Withdrawal	**Cap Failure**	**Under-layment Tear**
<u>"Code" Nail</u> 2012 IBC Cap Nail 0.105" nail diameter ring shank nail	31.8	1	7	8
0.083" nail diameter ring shank nail	32.4	0	4	2
21 Gage staple	36.2	0	0	5
18 Gage staple	32.1	0	2	9

[1] All cap fasteners had plastic caps meeting IBC requirements.

Cost Impact: The code change proposal will not increase the cost of construction. Proposed option would allow contractors to select option which provides equivalent protection with minimized material and labor costs.

RB429-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.2 #1-RB-KURTZ.doc

RB430 – 13
R905.2.7.2, R905.3.3.3, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, 905.8.3.2, R905.10.5.1

Proponent: John Kurtz, International Staple, Nail & Tool Association (mgraham@nrca.net)

Revise as follows:

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm~~). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.3.3.3 Underlayment and high winds. Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant

fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ <u>Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.</u>

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

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Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a~~

~~minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.7.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all Head laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). ~~Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm.) Metal caps shall have a thickness of at least 32-gauge sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm). The cap-nail shank shall be a minimum of 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nails shall have a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

Reason: The cap nail listed for attachment of roof covering underlayment in high-wind areas does not reflect commercially available cap nails successfully used in roofing material application. IRC presently lists a minimum nail shank diameter of 0.105". This proposal lowers the minimum shank diameter based on tests indicating underlayment tears before proposed cap nails fail. (Minimum diameter of 0.083" for ring shank cap nails and minimum diameter of 0.091" for smooth shank cap nails.)

Tests were conducted with ASTM D 4869 Type IV underlayment ("30 pound"). That underlayment is at high end of the thickness and toughness range of code-required underlayment - a "worst-case test" for the fastener. Proposal addresses both commercially available hand-driven and power-driven cap-nails.

Test procedure and results accompany this proposal. (below)

Report on Testing
July 2012

Testing was performed by Stanley Black & Decker at the request of International Staple, Nail and Tool Association (ISANTA.)

Reference Standards

State of Florida

- Testing Application Standards (TAS) published in the State of Florida Building Code, 2007 for High Velocity Hurricane Zone (HVHZ) product approval testing.
- TAS 111(B)-95, Test Procedure for Edge Metal Pull-off Performance.
- TAS 117(C)-95, Test Procedure for Dynamic Pull-off Performance of Roofing Nail Heads or Fasteners with Bearing Plates.
- TAS 117(A)-95, Test Procedure for Withdrawal Resistance Testing of Mechanical Fasteners Used in Roof System Assemblies.
- TAS 117(B)-95, test Procedure for Dynamic Pull-through Performance of Roofing Membranes over Fastener Heads or Fasteners with Metal Bearing Plates.

ASTM Standards

- D1037, Standard Test Methods for Evaluating Properties of Wood-base fiber and Particle Panel Materials, Nail head Pull-through Test.
- D4869, Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
- D412, Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

Acceptance Criteria

- ICC-ES, AC188: Acceptance Criteria for Roof Underlayments. July 2007.

Materials

- Roofing paper, 30# (ASTM D 4869, Type IV)
- Sheathing material – 4-ply, 15/32-in. Southern Pine Plywood, cut in 2 by 2 in. squares
- Fasteners – Ring shank cap nails with nail shank diameters before threading of 0.083 inch and 0.105 inch. Cap staples, 18 gage and 21 gage.
- Caps – 1 inch diameter plastic caps

Method - The test method was designed to facilitate one of three potential failure modes: cap failure, fastener withdrawal, or cap pulling through underlayment. A 14x14-in. sheet of underlayment was cut from the roll. The cap-fastener was driven through the center of the underlayment sheet into a 2x2-in. block of sheathing material. The assembled test specimen was turned over so that the sheathing block was visible and the fastener head was down. The assembled specimen was secured in the test fixture base with the fastener centered below sheathing block clamping fixture. The sheathing block was clamped by the fixture attached to the traversing head of the test machine. The test specimen was loaded at constant displacement of 1 in./min. until failure. Load and displacement were monitored continuously during the test. Failure mode was observed and peak force was recorded as the failure load. Photographs provided.

Discussion - The test is intended to evaluate the functionality of the ISANTA proposal for adding additional commercially available cap fasteners for use on same spacing as IBC's 0.105" cap nail with a plastic or metal 1" diameter cap (as specified.) The underlayment is not wind qualified. However, AC188 evaluation includes a requirement for tensile strength by using one of three ASTM standards, for example, ASTM D412. The AC does not include a punch-through or pull-through evaluation. The minimum tensile strength criterion of AC188 is 20 lbf/in-width. The 20 lbf/in-width is a valuable benchmark in that it could also be used to assess the potential uplift resistance of the underlayment because that is controlled by tensile strength.

Tensile strength also appears to be a predictor of pull-through performance. The 1-in. caps generally pulled through the underlayment at approximately 32 lb. Some nonlinear behavior occurs at the start of the loading process, then the load-deflection diagram becomes linear, and as the load approaches the maximum a minor plastic region develops that reflects fiber separation and cap yielding. This was generally characteristic for all cap-fasteners.

Conclusions - From the testing and review of test standards and acceptance criteria, we can conclude that the underlayment minimum tensile strength is the controlling strength property of the system and it can be used as a reasonable approximation of the potential holding capacity of the cap-fasteners based on the cap diameter. Engineering analysis of the negative pressures on roof surfaces should provide reasonable estimates of expected forces that will be resisted by fasteners and can be used to establish fastening schedules that reflect the fastener holding capacity (pull-through or withdrawal) and tensile strength of the underlayment when loaded as a membrane between fasteners.

Test machine fixtures for the pull-through test.

Pull-through test in progress; (left) early in test; (right) nearing failure.

Metal cap with roofing nail fastener after the pull-through test. Observe the permanent deformation of the metal cap and the pull-through tears in the underlayment.

Results of Cap Fastener Testing with ASTM D 4869, Type IV Underlayment

Cap Fastener [1]	Failure Load (pounds)	Number of Failures, by Failure Mode		
		Fastener Withdrawal	Cap Failure	Under-layment Tear
<u>"Code" Nail</u> 2012 IBC Cap Nail 0.105" nail diameter ring shank nail	31.8	1	7	8
0.083" nail diameter ring shank nail	32.4	0	4	2
21 Gage staple	36.2	0	0	5
18 Gage staple	32.1	0	2	9

[1] All cap fasteners had plastic caps meeting IBC requirements.

Cost Impact: The code change proposal will not increase the cost of construction. Proposed options would allow contractors to select options which provide equivalent protection with minimized material and labor costs.

RB430-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.2 #2-RB-KURTZ.doc

RB431 – 13

Table R905.2.7.1 (NEW), R905.2.7.2, R905.3.3.3, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: John Kurtz, International Staple, Nail & Tool Association (isanta@ameritech.net)

Revise as follows:

TABLE R905.2.7.1
ROOF COVERING UNDERLAYMENT ATTACHMENT

Alternate Fastener [a]	Maximum center-to-center spacing of alternate fasteners and grid lines if required center-to-center spacing of code fastener is	
	6" (152 mm) o.c.	12" (305 mm) o.c.
5/8" leg, 21 gage staple	3" (76 mm)	6" (152 mm)
21 gage staple	3" (76 mm)	7" (178 mm)
20 gage staple	4" (102 mm)	8" (203 mm)
0.080 -.083 diam. nail	4" (102 mm)	9" (229 mm)
0.090 diam. Nail 18 gage staple	5" (127 mm)	10" (254 mm)
0.105 diam. Nail (12 gage) 17 gage staple 0.120 diam. nail (11 gage)	6" (152 mm)	12" (305 mm)

a. Minimum nail shank length or staple leg length is 3/4" (19 mm) unless otherwise stated.

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

R905.3.3.3 Underlayment and high winds. Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/ 4-inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm).

Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

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Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
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Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all Head laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

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1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

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Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
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R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant

fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.
2. As an alternative, cap nails and cap staples complying with requirements of ASTM F1667 and fastened in accordance with Table R905.2.7.1 shall be permitted.

Reason: The fastener listed for attachment of roof covering underlayment in high-wind areas does not reflect commercially available fasteners successfully used in roofing material application. The code presently lists only one nail shank diameter, 0.105". This proposal addresses both commercially available hand-driven and power-driven cap-fasteners.

Tighter spacing of fasteners specified in the proposed table ensures that spacing of fasteners with diameters not currently specified in the Code would achieve equal (or greater) withdrawal strength than the currently listed nail diameter. Sufficient fastener withdrawal ensures that fastener shanks remain in roof deck while cap transfers uplift forces to the deck. This is a conservative approach because developing data indicates that the relevant failure mode is cap pulling through underlayment, rather than fastener shank withdrawal.

ASTM F1667-11a controls fastener nominal dimensions and tolerances as well as relevant fastener features.
Structure of proposal minimizes complexity of code requirements. An "Exception" is added to each roof covering's section. One table presents fastener spacing for all roof coverings.

Cost Impact: The code change proposal will not increase the cost of construction. The numerous options would allow contractors to select options which provide equivalent protection with minimized material and labor costs.

RB431-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905-RB-KURTZ.doc

RB432 – 13
R905.2.7.2, R905.3.3.3, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: Timothy Reinhold, Insurance Institute for Business & Home Safety

Revise as follows:

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$ inch (19 mm) into the roof sheathing.

Exceptions:

1. As an alternative, ~~adhered~~ self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
2. As an alternative, a minimum 4-inch wide strip of self-adhering polymer modified bitumen membrane complying with ASTM D 1970 installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering shall be applied over the 4-inch wide membrane strips.

R905.3.3.3 Underlayment and high winds. Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$-inch (19 mm) into the roof sheathing.

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1. As an alternative, ~~adhered~~ self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed shall be permitted.
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installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering shall be applied over the 4-inch wide membrane strips.

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

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R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

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R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

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R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant

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Exceptions:

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R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.

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Reason: This proposal simply seeks to provide clarity and additional specification for using a self-adhering polymer modified bitumen membrane as an underlayment in high wind regions. The proposal does not require the use of the self-adhering membrane, as it is already permitted by the code. In fact, the existing exception for using the self-adhering membrane was requested to be included by the IBC Structural Committee during the last code change cycle so that it was clear that a self-adhering membrane was permitted as an alternative to the underlayment provisions for high wind. This proposal simply clarifies the permitted installations of the self-adhering membrane that would provide an equivalent or better level of water intrusion prevention to the underlayment requirements for high wind. The criteria specified are consistent with the IBHS Fortified program requirements for creating a "sealed roof deck". Additionally, the provisions of this proposal are the most widely accepted methods recognized by insurance companies for providing discounts and credits in hurricane-prone regions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB432-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.2-RB-REINHOLD.doc

RB433 – 13
R905.2.7.2, R905.3.3.3, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: T. Eric Stafford, Insurance Institute for Business and Home Safety

Revise as follows:

R905.2.7.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center~~.

Underlayment installed where the basic wind speed equals or exceeds 110 ~~120~~ mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using corrosion resistant metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.3.3.3 Underlayment and high winds. ~~Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

Underlayment installed where the basic wind speed equals or exceeds 110 ~~120~~ mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Sections R905.3.3.1 and R905.3.3.2 ~~R905.2.7~~ except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using corrosion resistant metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4-inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.4.3.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

Underlayment installed where the basic wind speed equals or exceeds 110 ~~120~~ mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instruction ~~Section R905.2.7~~ except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using corrosion resistant metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.5.3.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

Underlayment installed where the basic wind speed equals or exceeds 110 ~~120~~ mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instruction ~~Section R905.2.7~~ except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using corrosion resistant metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.6.3.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

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R905.7.3.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.~~

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Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.8.3.2 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant~~

~~fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

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Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

R905.10.5.1 Underlayment and high winds. ~~Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

Underlayment installed where the basic wind speed equals or exceeds 110 ~~120~~ mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with the manufacturer's installation instruction ~~Section R905.2.7~~except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using corrosion resistant metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

Reason: Water intrusion continues to be an issue with hurricanes and high wind events. Significant improvements have been made recently to the codes and other voluntary methods that help prevent water intrusion through the roof decking when the primary roof covering has been blown off or damaged. These include the enhanced underlayment and high wind requirements in the 2012 IBC and the 2012 IRC in addition to the Sealed Roof Deck provisions recommended by the IBHS Fortified program and FEMA hurricane retrofit program guidance. Post-storm investigations also show that water intrusion is an issue in inland areas when the primary roof covering has been blown off.

This proposal seeks to lower the wind speed threshold that triggers the enhanced underlayment provisions from 120 mph to 110 mph. The original code change that pegged this trigger at 120 mph was developed to correspond with the wind speed maps in the 2009 IRC and ASCE 7-05. During the last code cycle, the wind speed maps in the IBC and IRC have been updated for consistency with ASCE 7-10. The wind speed map in the IRC is essentially the same map that is in ASCE 7-10, but the wind speed values have been converted to ASD levels specifically for the IRC. A simple conversion of the enhanced underlayment provisions wind speed trigger does not accurately reflect the intent of the original proposal, particularly as it relates to the geographic areas affected. The trigger as originally proposed, was essentially chosen to capture the coastal areas of the hurricane-prone regions, where the potential for loss of roof covering is increased, accompanied by exposure to significant amounts of rainfall. The trigger was chosen based up a geographic location on the wind speed map rather than a particular design limitation. However, the new maps in ASCE 7-10 have shifted the contours closer to the coast for the entire hurricane-prone region, which resulted in a reduction of the geographic area required to comply with the enhanced underlayment provisions. This proposal sets wind speed trigger for the enhanced underlayment provisions at 110 mph, which corresponds, better geographically with the 120 mph trigger that was intended to work the 2009 IRC and ASCE 7-05.

Cost Impact: The code change proposal will increase the cost of construction.

RB433-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.7.2-RB-STAFFORD.doc

RB434 – 13
R905.2.7.2, R905.4.3.2, R905.5.3.2, R905.6.3.2, R905.7.3.2, R905.8.3.2, R905.10.5.1

Proponent: Mark Zehnal, Florida Roofing, Sheet Metal and Air Conditioning Contractors Association (FRSA)

Revise as follows:

R905.2.7.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).
3. As an alternative, the entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions.

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.4.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side~~

~~laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).
3. As an alternative, the entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions.

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.5.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm).

Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.

2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).
3. As an alternative, the entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions.

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.6.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).
3. As an alternative, the entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions.

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.7.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.8.3.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center. Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^3/_4$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.10.5.1 Underlayment and high winds. Underlayment applied in areas subject to high winds [~~above 110 mph (49 m/s)~~ V_{ult} equals to or greater than 130 mph, in accordance with Figure R301.2(4)A] shall ~~be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of $^{3}/_{4}$ inch (19 mm) into the roof sheathing.~~ be installed using one of the following methods:

1. For roof slopes from two units vertical in 12 units horizontal (17-percent slope), and less than four units vertical in 12 units horizontal (33-percent slope). Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 4869, Type II or Type IV or ASTM D 6757 and shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with one row in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations.
2. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type IV or ASTM D 6757 and shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened with 1 inch (25 mm) round plastic cap, metal cap nails or nails and tin-tabs attached to a nailable deck with

two staggered rows in the field of the sheet with a maximum fastener spacing of 12 in. o.c. (305 mm), and one row at the overlaps fastened 6 in. o.c. (152 mm). Synthetic underlayment shall be fastened in accordance with this section and the manufacturer's recommendations End laps shall be offset by 6 feet (1829 mm).

3. As an alternative, the entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in accordance with the manufacturer's installation instructions.

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

Reason: Provides prescriptive attachment/installation guidelines for underlayment in high wind sections.

Cost Impact: The code change proposal will not increase the cost of construction.

RB434-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

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RB435 – 13

R905.1.1 (NEW), R905.1.2 (NEW), Table R905.1.1(1) (NEW), Table R905.1.1(2) (NEW), Table R905.1.1(3) (NEW), R905.2.3, R905.2.7, R905.2.7.1, R905.2.7.2, R905.3.3, R905.3.3.1, R905.3.3.2, R905.3.3.3, R905.4.3, R905.4.3.1, R905.4.3.2, R905.5.3, R905.5.3.1, R905.5.3.2, R905.6.3, R905.6.3.1, R905.6.3.2, R905.7.3, R905.7.3.1, R905.7.3.2, R905.8.3, R905.8.3.1, R905.8.3.2, R905.10.5, R905.10.5.1

Proponent: T. Eric Stafford, representing Insurance Institute for Business and Home Safety

Revise as follows:

R905.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, and metal roof panels shall be in accordance with this section. Underlayment types shall be in accordance with Table R905.1.1(1). Underlayment shall be applied in accordance with Table R905.1.1(2). Underlayment shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer modified bitumen underlayment complying with ASTM D 1970 installed in accordance with the manufacturer's installation instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.

2. As an alternative, a minimum 4-inch wide strip of self-adhering polymer modified bitumen membrane complying with ASTM D 1970 installed in accordance with the manufacturer's installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph shall be applied over the 4-inch wide membrane strips.

R905.1.2 Ice barriers. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier shall be installed for asphalt shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, and wood shakes. The ice barrier shall consists of at least two layers of underlayment cemented together or a self-adhering polymer modified bitumen sheet shall be used in place of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached *accessory structures* that contain no *conditioned floor area*.

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

Roof Covering	Section	Design Wind Speed < 120 mph	Design Wind Speed ≥ 120 mph
Asphalt shingles	R905.2	ASTM D 226 Type I ASTM D 4869 Type I ASTM D 6757	ASTM D 226 Type II ASTM D 4869 Type IV ASTM D 6757
Clay and concrete tile	R905.3	ASTM D 226 Type II ASTM D 2626 Type I ASTM D 6380 Class M mineral surfaced roll roofing	ASTM D 226 Type II ASTM D 2626 Type I ASTM D 6380 Class M mineral surfaced roll roofing
Metal roof shingles	R905.4	ASTM D 226 Type I or Type II ASTM D 4869 Type I or Type II	ASTM D 226 Type II ASTM D 4869 Type IV

Mineral-surfaced roll roofing	R905.5	ASTM D 226 Type I ASTM D 4869 Type I or Type II	ASTM D 226 Type II ASTM D 4869 Type IV
Slate and slate-type shingles	R905.6	ASTM D 226 Type I ASTM D 4869 Type I or Type II	ASTM D 226 Type II ASTM D 4869 Type IV
Wood shingles	R905.7	ASTM D 226 Type I ASTM D 4869 Type I or Type II	ASTM D 226 Type II ASTM D 4869 Type IV
Wood shakes	R905.8	ASTM D 226 Type I ASTM D 4869 Type I or Type II	ASTM D 226 Type II ASTM D 4869 Type IV
Metal panels	R905.10	Manufacturer's instructions	ASTM D 226 Type II ASTM D 4869 Type IV

TABLE R905.1.1(2)
UNDERLAYMENT APPLICATION

Roof Covering	**Section**	**Design Wind Speed < 120 mph**	**Design Wind Speed ≥ 120 mph**
Asphalt shingles	R905.2	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm). Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet (1829 mm).	Same as Design Wind Speeds < 120 mph except all laps shall be a minimum of 4 inches.
Clay and concrete tile	R905.3	For roof slopes from two and one-half units vertical in 12 units horizontal (2 1/2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be a minimum of two layers underlayment applied as follows. Starting at the eave,	Same as Design Wind Speeds < 120 mph except all laps shall be a minimum of 4 inches.

<table>
<tr><td></td><td></td><td>apply a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave. Starting at the eave, apply a36-inch-wide (914 mm) strips of underlayment felt shall be applied, overlapping successive sheets 19 inches (483 mm).

For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped 2 inches (51 mm). End laps shall be 4 inches and shall be offset by 6 feet (1829 mm).</td><td></td></tr>
<tr><td>Metal roof shingles</td><td>R905.4</td><td rowspan="6">Apply in accordance with the manufacturer's installation instructions.</td><td rowspan="6">For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently to hold in place.

For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 4 inches (51 mm), End laps shall be 4 inches and shall be offset by 6 feet (1829 mm).</td></tr>
<tr><td>Mineral-surfaced roll roofing</td><td>R905.5</td></tr>
<tr><td>Slate and slate-type shingles</td><td>R905.6</td></tr>
<tr><td>Wood shingles</td><td>R905.7</td></tr>
<tr><td>Wood shakes</td><td>R905.8</td></tr>
<tr><td>Metal panels</td><td>R905.10</td></tr>
</table>

TABLE R905.1.1(3)
UNDERLAYMENT ATTACHMENT

Roof Covering	Section	Design Wind Speed ≤ 110 mph	110 mph < Design Wind Speed < 120 mph	Design Wind Speed ≥ 120 mph
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	Corrosion-resistant fasteners in accordance with the manufacturer's installation instruction. Apply fasteners along laps not farther apart than 36 inches (914 mm) on center.	The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.
Clay and concrete tile	R905.3			
Metal roof shingles	R905.4	Manufacturer's installation instructions.	Corrosion-resistant fasteners in accordance with the manufacturer's installation instruction. Apply fasteners along laps not farther apart than 36 inches (914 mm) on center.	The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.
Mineral-surfaced roll roofing	R905.5			
Slate and slate-type shingles	R905.6			
Wood shingles	R905.7			
Wood shakes	R905.8			
Metal panels	R905.10			

R905.2.3 Underlayment. Underlayment shall comply with Section R905.1.1. ~~Unless otherwise noted, required underlayment shall conform to ASTM D 226 Type I, ASTM D 4869 Type I, or ASTM D 6757. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.~~

~~**R905.2.7 Underlayment application.** For roof slopes from two units vertical in 12 units horizontal (17-percent slope), up to four units vertical in 12 units horizontal (33- percent slope), underlayment shall be two layers applied in the following manner. Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the~~

~~shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be offset by 6 feet (1829 mm).~~

~~**R905.2.7.1**~~ **R905.2.7 Ice barrier.** Where required, ice barriers shall comply with Section R905.1.2. ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.2.7.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.3.3 Underlayment. Underlayment shall comply with Section R905.1.1. ~~Unless otherwise noted, required underlayment shall conform to ASTM D 226 Type II; ASTM D 2626 Type I; or ASTM D 6380 Class M mineral surfaced roll roofing.~~

~~**R905.3.3.1 Low slope roofs.** For roof slopes from two and one-half units vertical in 12 units horizontal (21/2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be a minimum of two layers underlayment applied as follows:~~

~~1. Starting at the eave, a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.~~
~~2. Starting at the eave, 36-inch-wide (914 mm) strips of underlayment felt shall be applied, overlapping successive sheets 19 inches (483 mm), and fastened sufficiently in place.~~

~~**R905.3.3.2 High slope roofs.** For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped 2 inches (51 mm), fastened sufficiently in place.~~

~~**R905.3.3.3 Underlayment and high winds.** Underlayment applied in areas subject to high wind [above 110 miles per hour (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Sections R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a~~

~~head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4-inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.4.3 Underlayment. Underlayment shall comply with Section R905.1.1. ~~ASTM D 226, Type I or Type II, ASTM D 4869, Type I or Type II, or ASTM D 1970. Underlayment shall be installed in accordance with the manufacturer's installation instructions.~~

R905.4.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2. ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.4.3.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II, ASTM D 4869 Type IV, or ASTM D 1970. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance withuSection R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32 gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.5.3 Underlayment. Underlayment shall comply with Section R905.1.1 ~~ASTM D 226, Type I or ASTM D 4869, Type I or II~~.

R905.5.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2. ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.5.3.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less~~

~~than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.6.3 Underlayment. Underlayment shall comply with <u>Section R905.1.1.</u> ~~ASTM D 226, Type I, or ASTM D 4869, Type I or II. Underlayment shall be installed in accordance with the manufacturer's installation instructions.~~

R905.6.3.1 Ice barrier. <u>Where required, ice barriers shall comply with Section R905.1.2.</u> ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.6.3.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.7.3 Underlayment. Underlayment shall comply with <u>Section R905.1.1.</u> ~~ASTM D 226, Type I or ASTM D 4869, Type I or II.~~

R905.7.3.1 Ice barrier. <u>Where required, ice barriers shall comply with Section R905.1.2.</u> ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.7.3.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7except all Head laps shall be a minimum of 4 inches~~

~~(102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.8.3 Underlayment. Underlayment shall comply with Section R905.1.1. ~~ASTM D 226, Type I or ASTM D 4869, Type I or II.~~

R905.8.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2. ~~In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.~~

~~**Exception:** Detached *accessory structures* that contain no *conditioned floor area*.~~

~~**R905.8.3.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II or ASTM D 4869 Type IV. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

R905.10.5 Underlayment. Underlayment shall comply with Section R905.1.1. ~~be installed in accordance with the manufacturer's installation instructions.~~

~~**R905.10.5.1 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.~~

~~Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 226 Type II. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.~~

~~**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.~~

Reason: This proposal is primarily a reorganization of the underlayment provisions contained within the IRC. In the current IRC, underlayment provisions are specified individually for each type of roof covering. Many of the roof covering provisions contain similar and overlapping requirements for underlayment type, application, and attachment. This proposal relocates the underlayment requirements for each roof covering to a single section at the beginning of Section R905. This reorganization results in three new tables that address underlayment type, application, and attachment for each of the roof covings in the IRC that require underlayment. Consolidating the underlayment requirements into a single section will make the provisions more user-friendly and in particular highlights the key differences between the requirements for underlayment for the different types of roof coverings addressed by the IRC.

This proposal also includes two minor technical changes. ASTM D 4859 Type IV underlayment is included as an acceptable underlayment for metal roof panels where wind speeds are 120 mph and greater. The IBC permits this underlayment for metal roof panels and there is no reason it should not be permitted for metal roof panels installed in accordance with the IRC.

The second technical change is primarily a clarification regarding the use of ASTM D 1970 as an underlayment. The proposal does not require the use of the self-adhering membrane, as it is already permitted by the code. In fact, the existing exception for using the self-adhering membrane was requested to be included by the IBC Structural Committee, and subsequently approved by the IRC Committee during the last code change cycle so that it was clear that a self-adhering membrane was permitted as an alternative to the underlayment provisions for high wind. This proposal simply clarifies the permitted installations of the self-adhering membrane that would provide an equivalent or better level of water intrusion prevention to the underlayment requirements for high wind. The criteria specified are consistent with the IBHS Fortified program requirements for creating a “sealed roof deck”. Additionally, the provisions of this proposal are the most widely accepted methods recognized by insurance companies for providing discounts and credits in hurricane-prone regions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB435-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.1.1 (NEW)-RB-STAFFORD.doc

RB436 – 13
R905.2.8.3

Proponent: Kirk Nagle, City of Arvada, CO, representing self (knagle@arvada.org)

Revise as follows:

R905.2.8.3 Sidewall flashing. Base flashing against a vertical sidewall shall be ~~continuous or~~ step flashing and shall be a minimum of 4 inches (102 mm) in height and 4 inches (102 mm) in width and shall direct water away from the vertical sidewall onto the roof and/or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding. Where anchored masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and counterflashing shall be provided in accordance with Section R703.7.2.2. Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and Section R703.6.3.

Reason: Step flashing is the approved method of installation by the asphalt roofing manufacturers for sidewall intersections. The method of continuous flashing was removed from the codes in the late 90's because it was a serious problem for leaking, deteriorated roof sheathing and mold. The step flashing moves the water from each layer onto the top of the shingle below so it can move to the gutter and not under the roofing material. If a continuous piece of flashing is used the water can continue under the shingles and eventually onto the underlayment where it can leak and keep the underside of the roofing material wet for long periods of time causing the growth of mold. This installation was used by roofing contractors and was continuous problem for the owners of buildings/homes. The problem was initially thought to be solved by allowing continuous flashing with a kick back (a piece of the metal bent back at over 45 degrees approximately ½ inch of metal) that would keep the water on the continuous flashing and eventually to the gutter, however this created water under the roofing material which would allow for mold growth and leaking. Proper step flashing applied to each shingle puts the water on the upper part of the shingle below and onto the exposed roofing material, which will prevent mold growth and leaking, by having the water under the shingles. I have repaired this problem on many roofs in the past and as a roofing inspector diagnosed the problem of leaks and observed roofing material destroyed by water, roof sheathing destroyed by mold and leaking because water go under the shingles. The water behaves like a funnel one it has a place to go it moves in that direction, just like a siphon. The water moves under the shingles, builds up hydrostatic pressure and forces its way into the tiniest of holes to leak or just keep the underside of the roofing material wet. The continuous flashing was removed from the codes for these reasons and should be removed from the codes today to have proper water resistive systems in place for all buildings/homes.

Cost Impact: The code change proposal will not increase the cost of construction, but will reduce the cost of building maintenance.

RB436-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.8.3-RB-NAGLE.doc

RB437 – 13
R905.2.8.3

Proponent: Thomas M. Pino, Sweetwater Home Inspection

Delete and substitute as follows:

~~**R905.2.8.3 Sidewall flashing.** Base flashing against a vertical sidewall shall be continuous or step flashing and shall be a minimum of 4 inches (102 mm) in height and 4 inches (102 mm) in width and shall direct water away from the vertical sidewall onto the roof and/or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding. Where anchored masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and counterflashing shall be provided in accordance with Section R703.7.2.2. Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and Section R703.6.3.~~

R905.2.8.3 Sidewall flashing. Flashing against a vertical sidewall shall be by the step-flashing method. The flashing shall be a minimum of 4 inches (102 mm) high and 4 inches (102 mm) wide. At the end of the vertical sidewall the step flashing shall be turned out in a manner that directs water away from the wall and onto the roof and/or gutter.

Reason: Reason: Eliminating the need for properly sized step flashing when using asphalt roof shingles has poor implication especially in 100 mile per hour or above high shear wind conditions as is noted under the code number R301.2. BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE INTERVAL. All major asphalt roofing manufacturers require the each shingle be nailed between 1 and $1^1/_2$ inch from the edge of the shingle. With a continuous flashing method that is allowed in the 2012 edition of the IRC, the continuous flashing does not allow the roofer to nail within 6 to 8 inches from the edge of the shingle. Therefore when high wind shear factors hit these areas even if just one shingle that is not properly nailed, that shingle can blow off creating areas where water can penetrate. After the hurricane “Ike” that hit Galveston County, Harris County, Brazoria County, Fort Bend County Chambers County, Liberty County and others in Texas with much of the damage to the roofs was due to use of continuous flashing methods. On the majority of the residential homes that had proper step flashing installed little or no roof damage was done because of blow off. Whereas where roof damage was evident one of the main cause was due to the continuous flashing which brought on further damage to the structure through water penetration.

The code R905.2.8.3 of the IRC 2009 edition addresses this issue and specifically stating that step flashing shall be used. Period. The same code in the 2012 edition specifically states “OR” a continuous flashing shall be used. (By the way, at the end of the code it states, “in accordance with” and on the next page it does not continue on the next page.) Was this a typographical error?

Step flashing methods have been around for 8 or more decades and have performed adequately in almost all cases. Continuous flashing method is used to shorten the time it takes to nail a shingle on the roof decking and cut costs but has not proven to always function as a proper flashing method.

Cost Impact: This code change will increase the cost of construction. Minimal cost to a builder and/or a roofing contractor.

RB437-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.8.3-RB-PINO.doc

RB438 – 13
R905.2.8.5

Proponent: Bill McHugh, Chicago Roofing Contractors Association (bill@crca.org)

Revise as follows:

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and gables of shingle roofs. Adjacent pieces of drip edge shall be overlapped a minimum of 2 inches (51 mm). Drip edges shall extend a minimum of 0.25 inch (6.4 mm) below the roof sheathing and extend up the roof deck a minimum of 2 inches (51 mm). Drip edges shall be mechanically fastened to the roof deck at a maximum of 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed ~~over~~ <u>under</u> the drip edge along eaves and under the underlayment on gables. Unless specified differently by the shingle manufacturer, shingles are permitted to be flush with the drip edge.

Reason: The roof edge flashings are most susceptible to leaks from water backing up under the underlayment and roof covering because it freezes at the eave edge first causing water to lay on the roof driving water back up the slope of the structure.

According to CRCA roofing contractors, if the code required underlayment is applied to the top of the metal drip edge, a seal may be difficult and the water will leak into the structure where a void exists. Voids form due to joints in the metal, uneven or dirty surfaces before application of the underlayment. Further, if underlayment is applied to these flashings, water can be pushed by the ice dam working on the 'back water lap' up slope possibly causing leaks. The leak(s) may be difficult to detect in the concealed space location.

We believe this will provide needed guidance in new construction, reroofing, roof recover and roof replacements providing better service and less leaks to the residential building owner.

Cost Impact: This proposal will not increase the cost of construction.

RB438-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.8.5-RB-MCHUGH.doc

RB439 – 13
R905.2.8.5

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and ~~gables~~ rake edges of shingle roofs. Adjacent ~~pieces~~ segments of drip edge shall be overlapped a minimum of 2 inches (51 mm). Drip edges shall extend a minimum of 0.25 inch (6.4 mm) below the roof sheathing and extend ~~up~~ back on to the roof deck a minimum of 2 inches (51 mm). Drip edges shall be mechanically fastened to the roof deck at a maximum of 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed over the drip edge along eaves and under the underlayment ~~on gables~~ along rake edges. ~~Unless specified differently by the shingle manufacturer, shingles are permitted to be flush with the drip edge.~~

Reason: This code change proposal is intended to clarify the Code's intent regarding drip edges for asphalt shingle roofs, makes the provision conform to industry practices and makes the IRC's requirements consistent with the requirements in IBC's Section 1507.2.9.3, which was modified by Group A code change S36-12 that was Approved as Modified.

Cost Impact: This code change proposal will not increase the cost of construction.

RB439-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.8.5-RB-GRAHAM.doc

RB440 – 13
R905.2.8.5

Proponent: Rick Davidson, City of Maple Grove, MN, representing Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Delete without substitution as follows:

~~**R905.2.8.5 Drip edge.** A drip edge shall be provided at eaves and gables of shingle roofs. Adjacent pieces of drip edge shall be overlapped a minimum of 2 inches (51 mm). Drip edges shall extend a minimum of 0.25 inch (6.4 mm) below the roof sheathing and extend up the roof deck a minimum of 2 inches (51 mm). Drip edges shall be mechanically fastened to the roof deck at a maximum of 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed over the drip edge along eaves and under the underlayment on gables. Unless specified differently by the shingle manufacturer, shingles are permitted to be flush with the drip edge.~~

Reason: The requirement for drip edge was placed in the code during the past cycle. Following is the reason given by the proponent for the change:

> **Reason:** Unlike the IBC, the IRC does not include drip edge requirements for shingle roofs. This new text brings the IRC into uniformity with the IBC, reflects manufacturers' requirements for shingle roof installations, and uses identical wording and placement as found in IBC 1507.2.9.3.
>
> **Cost Impact:** The code change proposal will not increase the cost of construction.

The proponent's arguments are somewhat conflicted. Although the IBC does require drip edge, the solution for consistency should have been to remove it from the IBC rather than add it to the IRC. The proponent stated that it reflects manufacturer's requirements for shingle roof installations. The proponent provided no evidence of this in support of the statement and, if manufacturers do require drip edge, it would be required by existing language in the IRC (see end of section). In fact, the Asphalt Roofing Manufacturer's Association only ***recommends*** the use of drip edge; they do not say it is required. Then the proponent stated that requiring drip edge where it wasn't previously required would ***not*** increase the cost of construction. Clearly this will increase the cost of construction.

While the committee approved this proposal, their reason statement makes little sense. They state that the drip edge "will provide protection of the shingles and give(s) rigidity to the shingle edges". I'm not sure how drip edge protects the shingles and the projection of the shingles over the roof edge is governed by the manufacturer's installation instructions. Sometimes finding a good reason to approve something is a struggle.

> **Committee Reason:** This is a good change that will provide protection of the shingles and gives rigidity to the shingle edges. This is consistent with the IBC.

The code language also creates a number or problems that need to be considered. The 2012 IRC has been amended to permit overlays (again). The question that comes up is how drip edge can or should be installed in an overlay situation. The Asphalt Roofing Manufacture's Association and drip edge manufacturers don't address that problem. Also, installing drip edge on existing homes with gutters creates another unique problem. Many of the attachment methods for gutters make it virtually impossible to install drip edge along an eave without cutting the drip edge to pieces or removing and reinstalling the gutters which drives up the cost. And there are sure to be roofing contractors who will use the new rules to increase installation costs on their customers and blame the increase on the local building department.

SECTION R905
REQUIREMENTS FOR ROOF COVERINGS

> ***R905.1 Roof covering application.*** *Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. Unless otherwise specified in this section, roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).*

It is reasonable that this proposal be approved because the current language in the IRC is not well thought out, will create conflicts for reroofing, was not shown to be necessary or to serve any useful purpose, and will increase the cost of construction.

Cost Impact: The code change proposal will not increase the cost of construction.

RB440-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.8.5-RB-DAVIDSON.doc

RB441 – 13
R905.2.9 (NEW)

Proponent: Andrew Herseth, US Dept of Homeland Security, representing Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Add new text as follows:

R905.2.9 Cold Weather Application. The installation of asphalt shingles during cold weather (less than 40° F [5° C]) shall comply with the manufacturer's cold weather installation instructions.

Reason: If shingles are installed during cold weather, the shingle's thermally activated tab sealant may not activate and seal the tabs. When tabs are unsealed, they are susceptible to wind blow-off. The sealant may activate during return of warm weather, but proper sealing may be inhibited by contaminates blown onto the sealant before thermal activation occurs.

Most manufacturers provide special instructions for installing shingles during cold weather - typically through applying dabs of adhesive to the backs of the each tab. Section R905.1 already requires installation to comply with the manufacturer's installation instructions. However, this code change proposal explicitly directs attention to the issue of cold weather application, and it facilitates code enforcement by defining "cold weather".

Cost Impact: The code change proposal will not increase the cost of construction because if R905.1 is followed, the application would be in accordance with the manufacturer's cold weather application instructions.

RB441-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.2.9 (NEW)-RB-HERSETH-OVERCASH.doc

RB442 – 13
R905.6

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.6 Slate ~~and slate-type~~ shingles. The installation of slate ~~and slate-type~~ shingles shall comply with the provisions of this section.

Reason: This code change proposal is intended to remove "slate-type" shingle products from being applicable to this section. Slate-type products are not defined and the material standard requirement in Section R905.6.4-Material Standards applies specifically to slate products and not synthetic slate or slate-type products.

Cost Impact: The code change proposal will not increase the cost of construction.

RB442-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.6-RB-GRAHAM.doc

RB443 – 13
R905.14.2, Chapter 44

Proponent: Steve Loftis, NFCI Polyurethanes

Revise as follows:

R905.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ~~ASTM C 1029, Type III or IV~~ ASTM D7425.

Add new standard to Chapter 44 as follows:

ASTM

D 7425-11 Standard Specification for Spray Polyurethane Foam Used for Roofing Applications

Reason: ASTM D7425 Standard Specification for Spray Polyurethane Foam Used for Roofing Applications was developed to establish the required physical properties of spray foam (SPF) for use in SPF roofing applications. ASTM C1029 is a specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation and does not specifically address properties of SPF for use in roofing applications. ASTM D7425 is the appropriate reference standard.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM D 7425 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB443-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.14.2-RB-LOFTIS.doc

RB444 – 13
R202 (NEW), R902, R902.1, R902.3 (NEW), R902.4 (NEW)

Proponent: Lorraine Ross, Intech Consulting Inc., representing The Dow Chemical Company (intech@tampabay.rr.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE IRC RESIDENTIAL BUILDING CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY IRC PLUMBING/MECHANCIALCODE DEVELOPMENT COMMITTEE.

PART I – IRC BUILDING

Revise as follows:

SECTION R902
~~ROOF~~ FIRE CLASSIFICATION

R902.1 Roofing covering materials. Roofs shall be covered with materials as set forth in Sections R904 and R905. Class A, B or C roofing shall be installed in ~~areas~~ jurisdictions designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a lot line. Classes A, B and C roofing required by this section to be listed shall be tested in accordance with UL 790 or ASTM E 108.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry and exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile, or slate installed on noncombustible decks.
3. Class A roof assemblies include minimum 16 oz/ft^2 copper sheets installed over combustible decks.

R902.3 Building integrated photovoltaic product. Building integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section R902.1.

R902.4 Rooftop mounted photovoltaic panels and modules. Rooftop mounted photovoltaic panels and modules installed on or above the roof covering shall be tested, *listed* and identified with a fire classification in accordance with UL 1703. Class A, B or C photovoltaic panels and modules shall be installed in jurisdictions designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a lot line.

PART II – IRC PLUMBING/MECHANICAL

Add new definitions as follows:

BUILDING INTEGRATED PHOTOVOLTAIC (BIPV) PRODUCT. A building product that incorporates photovoltaic modules, and functions as a component of the building envelope.

PHOTOVOLTAIC MODULE. A complete,environmentallyprotected unit consisting of solar cells,optics, and other components,exclusive of tracker, designed to generate DC power when exposed to sunlight.

PHOTOVOLTAIC PANEL. A collection of photovoltaic modules mechanically fastened together,wired, and designed to provide a field-installable unit.

Reason: This section has been renamed Fire Classification in order to clarify the subject of the section. Two new sections have been added to clearly identify the fire classification requirements for both building integrated photovoltaic products that serve as the roof covering and rooftop mounted photovoltaic panels that are installed on or above the roof covering. This concept was also approved in the 2015 *International Building Code* development process.

There is also a change to clarify Section 902.1, where the word "area" was changed to "jurisdiction" because there has been interpretation that the word "area" referred to is a place on the roof itself rather than a geographic area, such as the Urban Wildfire Interface Zone or other jurisdictional requirements for fire classified roofs. Section 902 is in place to prevent fire from spreading from rooftop to rooftop. Where classified roofs are required, it applies to the entire roof not just portions or "areas" of the roof.

New definitions are added for BUILDING INTEGRATED PHOTOVOLTAIC (BIPV) PRODUCT, PHOTOVOLTAIC MODULE and PHOTOVOLTAIC PANEL. All of these definitions were approved in the 2015 International Building Code development process.

Cost Impact: The code change proposal will not increase the cost of construction.

RB444-13
PART I – IRC BUILDING

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II – IRC PLUMBING/MECHANICAL

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R902-RB-ROSS.doc

RB445 – 13
R202, R905.16, R905.16.1, R905.16.2, R905.16.3

Proponent: Lorraine Ross, Intech Consulting Inc., representing The Dow Chemical Company (intech@tampabay.rr.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE IRC RESIDENTIAL BUILDING CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY IRC PLUMBING/MECHANCIALCODE DEVELOPMENT COMMITTEE.

PART I – IRC BUILDING

Revise as follows:

R905.16 Photovoltaic ~~modules/~~shingles. The installation of photovoltaic ~~modules/~~shingles shall comply with the provisions of this section.

R905.16.1 Material standards. Photovoltaic ~~modules/~~shingles shall be listed and labeled in accordance with UL 1703.

R905.16.2 Attachment. Photovoltaic ~~modules/~~shingles shall be attached in accordance with the manufacturer's installation instructions.

R905.16.3 Wind resistance. Photovoltaic ~~modules/~~shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic ~~modules/~~shingles shall comply with the classification requirements of Table R905.2.4.1(2) for the appropriate maximum basic wind speed. Photovoltaic ~~modules/~~shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table R905.2.4.1(2).

PART II – IRC PLUMBING/MECHANICAL

Revise definitions as follows:

PHOTOVOLTAIC ~~MODULES/~~SHINGLES. A *roof covering* ~~composed of flat-plate photovoltaic modules fabricated in sheets that resemble three-tab composite~~ <u>resembling</u> shingles <u>that incorporates photovoltaic</u> <u>modules</u>.

<u>**PHOTOVOLTAIC MODULE.** A complete,environmentally protected unit consisting of solar cells,optics, and other components,exclusive of tracker, designed to generate DC power when exposed to sunlight.</u>

Reason: This code change is intended to coordinate with action taken for photovoltaic shingles in the 2015 *International Building Code* development hearings. Appropriate section numbers have been added here for the *International Residential Code*. Both definitions proposed in this code change were also approved in the 2015 IBC.

The successful IBC code change was referenced as S2-12 and contained this reasoning statement:

"This code change proposal is intended to clarify the term and definition for "Photovoltaic modules/shingles" in Chapter 2-Definitions and carrying this clarification through to the specific requirements for photovoltaic shingles in Section 1507.17

The word "modules" is being deleted from the term and definition because it is not defined in the code in the context of photovoltaic applications and it is not necessary to clearly identify and define the term. Similarly, "/" is being deleted because it is not necessary to identify or define the term; it is not clear whether the "/" is intended to mean "and" or "or". Also, "flat-plate", "three-tab" and "composite" are being deleted because these are not defined in the IBC and these are not necessary to clearly define the term."

No changes in the current code's technical requirements are intended with this code change proposal."

Cost Impact: The code change will not increase the cost of construction.

RB445-13
PART I – IRC BUILDING

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II – IRC PLUMBING/MECHANICAL

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.16-RB-ROSS.doc

RB446 – 13
R905.16, R905.16.1, R905.16.2, R905.16.3, R905.16.4, R905.16.4.1, R905.16.4.2

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R905.16 Photovoltaic ~~modules/~~shingles. The installation of photovoltaic ~~modules/~~shingles shall comply with the provisions of this section, Section M2302 and NFPA 70.

R905.16.1 Deck requirements. Photovoltaic shingles shall be applied to a solid or closely-fitted deck, except where the roof covering is specifically designed to be applied over spaced sheathing.

R905.16.2 Deck slope. Photovoltaic shingles shall be used only on roof slopes of three units vertical in 12 units horizontal (3:12) or greater.

R905.16.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 4869 or ASTM D6757.

R905.16.4 Underlayment application. Underlayment shall be applied shingle fashion, parallel to and starting from the eave, lapped 2 inches (51 mm) and fastened sufficiently to hold in place.

R905.16.4.1 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2(1), an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached *accessory structures* that contain no *conditioned floor area*.

R905.16.4.2 Underlayment and high winds. Underlayment applied in areas subject to high winds [above 110 mph (49 m/s) in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the basic wind speed equals or exceeds 120 mph (54 m/s) shall comply with ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied in accordance with Section R905.2.7 except all laps shall be a minimum of 4 inches (102 mm). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25.4 mm) with a thickness of at least 32-gauge sheet metal. The cap-nail shank shall be a minimum of 12 gauge (0.105 inches) with a length to penetrate through the roof sheathing or a minimum of 3/4 inch (19 mm) into the roof sheathing.

> **Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

~~R905.16.1~~ **R905.16.5 Material standards.** Photovoltaic ~~modules/~~shingles shall be listed and labeled in accordance with UL 1703.

~~R905.16.2~~ **R905.16.6 Attachment.** Photovoltaic ~~modules/~~shingles shall be attached in accordance with the manufacturer's installation instructions.

~~R905.16.3~~ **R905.16.7 Wind resistance.** Photovoltaic ~~modules/~~shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic ~~modules/~~shingles shall comply with the classification requirements of Table R905.2.4.1(2) for the appropriate maximum basic wind speed. Photovoltaic ~~modules/~~shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table R905.2.4.1(2).

Reason: This code change proposal adds specific requirements for roof decks, roof deck slope, underlayment, underlayment application, ice barrier, and underlayment for high wind areas to Section R905.16.

The specific requirements being added are consistent with similar attributes for other steep-slope, shingle-type roof coverings.

Reference to IRC Section M2302-Photovoltaic Solar Energy Systems and NFPA 70 is added.

This same code change proposal was submitted for consideration as S47-12 for Group A of the International Building Code and was Approved as Modified; the modifications are included as a part of this text here

Cost Impact: The code change proposal will not increase the cost of construction.

RB446-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R905.16-RB-GRAHAM.doc

RB447 – 13
R907 (NEW)

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Add new text as follows:

SECTION R907
ROOFTOP-MOUNTED PHOTVOLTAIC SYSTEMS

R907.1 Rooftop-mounted photovoltaic systems. Rooftop-mounted photovoltaic panels or modules shall be installed in accordance with this section, Section M2302 and NFPA 70.

R907.2 Wind resistance. Rooftop-mounted photovoltaic panel or modules systems shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R907.3 Fire classification. Rooftop-mounted photovoltaic panels or modules shall have the same fire classification as the roof assembly required in Section R902.

R907.4 Installation. Rooftop mounted photovoltaic panels or modules shall be installed in accordance with the manufacturer's installation instructions.

R907.5 Photovoltaic panels and modules. Rooftop-mounted photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 and shall be installed in accordance with the manufacturer's printed installation instructions.

Reason: : This code change proposal is intended to add specific requirements applicable to rooftop-mounted photovoltaic panels and modules, and complement the already existing requirements for photovoltaic solar energy systems in Section M2302.

The roofing-specific requirements proposed here are adapted from IBC Section 1509.7-Photovoltaic Systems, which address rooftop-mounted panel and rack systems.

Building-integrated photovoltaic systems, such as photovoltaic shingles, are already addressed in IRC Section 905.16.

Cost Impact: The code change proposal will not increase the cost of construction.

RB447-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907 (NEW)-RB-GRAHAM.doc

RB448 – 13

R202 (NEW), R902.3 (NEW), R908 (NEW), M2302, M2302.2, M2302.2.1, M2302.2.2, M2302.2.3, M2302.3, M2302.4

Proponent: Lorraine Ross, Intech Consulting Inc., representing The Dow Chemical Company (intech@tampabay.rr.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE IRC RESIDENTIAL BUILDING CODE DEVELOPMENT COMMITTEE AND PART II WILL BE HEARD BY IRC PLUMBING/MECHANCIALCODE DEVELOPMENT COMMITTEE.

PART I – IRC BUILDING

Add new text as follows:

R902.3 Rooftop mounted photovoltaic panels and modules. Rooftop mounted photovoltaic panels and modules mounted on or above the roof covering shall be tested, *listed* and identified with a fire classification in accordance with UL 1703. Class A, B or C photovoltaic panels and modules shall be installed in jurisdictions designated by law as requiring their use or when the edge of the roof is less than 3 feet (914 mm) from a lot line.

SECTION R908
ROOFTOP MOUNTED PHOTOVOLTAIC PANEL SYSTEMS

R908.1 General. The installation of photovoltaic panel systems that are mounted on or above the roof covering shall comply with the provisions of this code, the *International Fire Code* and *NFPA 70*.

R908.1.1 Material standards. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703.

R908.1.2 Structural requirements. Rooftop mounted photovoltaic panel systems shall be designed to structurally support the system and withstand applicable loads in accordance with Chapter 3. The roof upon which these systems are installed shall be constructed to support the loads imposed by such systems in accordance with Chapter 8.

R908.1.3 Installation. Rooftop mounted photovoltaic systems shall be installed in accordance with the manufacturer's installation instructions. Roof penetrations shall be flashed in accordance with this chapter.

R908.1.4 Inverters. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

PART II – IRC PLUMBING/MECHANICAL

Add new definitions as follows:

PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics, and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight.

PHOTOVOLTAIC PANEL. A collection of photovoltaic modules mechanically fastened together, wired, and designed to provide a field-installable unit.

PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels, which convert solar radiation into electricity, including rack support systems.

Add new text as follows:

SECTION M2302
GROUND MOUNTED PHOTOVOLTAIC SOLAR ENERGY SYSTEMS

M2302.1 General. This section provides for the design, construction, installation, alteration, and repair of ground mounted photovoltaic equipment and systems.

M2302.2 Requirements. The installation, inspection, maintenance, repair and replacement of ground-mounted photovoltaic systems and all system components shall comply with the manufacturer's instructions, Sections M2302.2.1 through M2302.2.3, the *International Fire Code* and NFPA 70.

~~**M2302.2.1 Roof-mounted panels and modules.** Where photovoltaic panels and modules are installed on roofs, the roof shall be constructed to support the loads imposed by such modules. Roof-mounted photovoltaic panels and modules that serve as roof covering shall conform to the requirements for roof coverings in Chapter 9. Where mounted on or above the roof coverings, the photovoltaic panels and modules and supporting structure shall be constructed of noncombustible materials or fire-retardant treated wood equivalent to that required for the roof construction~~

~~**M2302.2.2 Roof and wall penetrations.** Roof and wall penetrations shall be flashed and sealed in accordance with Chapter 9 to prevent entry of water, rodents, and insects.~~

~~**M2302.2.3**~~ **M2302.2.1 Ground-mounted panels and modules.** Ground-mounted panels and modules shall be designed in accordance with Section R301 and installed in accordance with the manufacturer's instructions.

~~**M2302.3**~~ **M2302.2.2 Ground-mounted Photovoltaic panels and modules.** Ground-mounted Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703.

~~**M2302.4**~~ **M2302.2.3 Inverters.** Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

Reason: Installation of rooftop mounted photovoltaic panel systems is common in the residential market. Yet, specific details about installation of these systems are missing, vague or buried in the mechanical chapter Section M2302. This code proposal adds a new Section R908 to Chapter 9 to clarify details for the design and installation of rooftop mounted photovoltaic panels installed on or above the roof covering. In doing so, a number of other sections have been added or revised. Details of the proposal are explained as follows:

1. **New definitions for PHOTOVOLTAIC MODULE, PHOTOVOLTAIC PANEL, and PHOTOVOLTAIC PANEL SYSTEM.** All of these definitions were approved in the 2015 *International Building Code* development process.
2. **Adds fire classification section for rooftop mounted photovoltaic panels and modules mounted on or above the roof covering.** Specific details on this provision is missing from the *International Residential Code* and is a critical factor in the safe installation of rooftop mounted photovoltaic systems.
3. **New Section R908 ROOFTOP MOUNTED PHOTOVOLTAIC PANEL SYSTEMS** This code change proposal places requirements for rooftop mounted photovoltaic panel systems that are installed on or above the roof covering in Chapter 9 as a new Section R908, which is a much more logical place. The General section references the need to comply with this section as well as the *International Fire Code* and NFPA 70. Other important provisions for safe installation of these systems are detailed, including material standards, structural requirements, installation and inverters. Likewise, provisions for these systems in Section 2302 are deleted. Section 2302 is now limited to ground-mounted photovoltaic systems and has been amended accordingly.
4. **Revise Section M2302.** Since this code change proposal relocates all rooftop photovoltaic provisions, Section M2302 is now limited to ground-mounted photovoltaic systems and has been revised accordingly. A requirement to design these systems in accordance with Section R301 has been added.

Cost Impact: The code change proposal will not increase the cost of construction.

RB448-13
PART I – IRC BUILDING

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

PART II – IRC PLUMBING/MECHANICAL

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R902.3 (NEW)-RB-ROSS.doc

RB449 – 13
Table R906.2

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

TABLE R906.2
MATERIAL STANDARDS FOR ROOF INSULATION

Cellular glass board	ASTM C 552
Composite boards	ASTM C 1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C 578
Extruded polystyrene board	ASTM C 578
Perlite board	ASTM C 728
Polyisocyanurate board	ASTM C 1289, Type I or II
Wood fiberboard	ASTM C 208
<u>Fiber-reinforced gypsum board</u>	<u>ASTM C1278</u>
<u>Glass-faced gypsum board</u>	<u>ASTM C1177</u>

Reason: This code change proposal is intended to add recognized product standards to Table R906.2-Material Standards for Roof Insulation for fiber-reinforced gypsum board and glass-faced gypsum board commonly used in roof assemblies.

ASTM C 1278, "Standard Specification for Fiber-Reinforced Gypsum Panel," is the U.S. product standard applicable to fiber-reinforced gypsum board used in roof assemblies.

ASTM C1177, "Standard Specification for Glass Mat Substrate Used as Sheathing," is the U.S. product standard applicable to glass-faced gypsum board used in roof assemblies.

This same code change proposal was submitted for the International Building Code as S50-12 in Group A and was Approved as Submitted.

Cost Impact: The code change proposal will not increase the cost of construction.

RB449-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R906.2T-RB-GRAHAM.doc

RB450 – 13
R202 (NEW), R907 (NEW), Chapter 44

Proponent: Vickie Lovell, InterCode Incorporated, representing the Reflective Insulation Manufacturers Association International (Vickie@intercodeinc.com)

Revise as follows:

SECTION R907
RADIANT BARRIER-ABOVE DECK

R907.1 General. A radiant barrier installed above a deck shall comply with Sections R907.2 through R907.4.

R907.2 Fire Testing. Radiant barriers shall be permitted for use above decks where the radiant barrier is covered with an *approved* roof covering and the system consisting of the radiant barrier and the roof covering complies with the requirements of either FM 4550 or UL 1256.

R907.3 Installation. The low emittance surface of the radiant barrier shall face the continuous air space between the barrier and the roof covering.

R907.4 Material standards. A radiant barrier installed above a deck shall comply with ASTM C1313/C1313M.

Add new definition as follows:

RADIANT BARRIER. A material having a low emittance surface of 0.1 or less installed in building assemblies.

Add new standard to Chapter 44 as follows:

ASTM

C1313/C1313M-12 Standard Specification for Sheet Radiant Barriers for Building Construction Applications

Reason: The IBC understood this and accepted S51-12, which introduced a new section 1509, following section 1508 on Roof Insulation, associated with Radiant barriers above deck. The present proposal uses the same language accepted into the IBC and proposes it for the IRC, once more following the section on roof insulation (R906) and not as another part of that section.

The new text is necessary for the following reasons:
(1) An important issue that needs to be addressed in the new proposed section R907 is how the fire testing of the system is to be done. The fire testing (FM 4550 or 1256) must be done using the combination of the radiant barrier **and** the approved roof covering and the total system needs to pass the fire test.
(2) A definition is needed for radiant barriers, and one is being proposed, which is identical to the one adopted by the IBC.
(3) A standard specification needs to be referenced, and the same specification (ASTM C1313) is being proposed as was adopted by the IBC.
(4) A key requirement for the installation of radiant barrier products is that there needs to be an air space or air gap between the radiant barrier and the roof covering. This is explained in the proposed section on installation. There is confusion in the market place concerning this "air space" or "air gap". All radiant barrier applications require an air space on at least one low emittance side of the material. Installations that do not to include an air space do not provide the desired radiant barrier benefit.

Radiant barrier products have been on the market for over 24 years and are used by 87 of the top 100 US Builders. They have an established history and have been accepted into several regional code requirements [building codes in Hawaii, Austin, Texas, Florida and I California's Title 24] and are included in the Energy Star Homes Guidelines.

For information, ASTM has issued separate specifications for radiant barriers used in buildings ASTM C1313, "Standard Specification for Sheet Radiant Barriers for Building Construction Applications" and for reflective insulations used in buildings ASTM C1224, "Standard Specification for Reflective Insulation for Building Applications". This proposal includes a reference to the appropriate specification, ASTM C1313. The scope of ASTM C1313 reads as follows. "This specification covers the general physical property requirements of radiant barrier materials for use in building construction. The scope is specifically limited to requirements for radiant barrier sheet materials that consist of at least one surface, such as metallic foils or metallic deposits mounted or unmounted on substrates. Sheet radiant barrier materials shall consist of low emittance surface(s) that may be in combination with any substrates and adhesives required to meet the specified physical material properties. The following test methods shall be performed: surface emittance; water vapor transmission; surface burning characteristics; corrosivity; tear resistance; and adhesive performance."

Cost Impact: This proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, ASTM C 1313/ C1313M with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB450-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907 (NEW)-RB-LOVELL.doc

RB451 – 13
R907.1

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

R907.1 General. Materials and methods of application used for re-covering or replacing an existing roof covering shall comply with the requirements of Chapter 9.

Exceptions:

1. Reroofing shall not be required to meet the minimum design slope requirements of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section R905 for roofs that provide positive drainage.
2. For roofs that provide positive drainage, re-covering or replacing an existing roof covering shall not require the secondary (emergency overflow) drains or scuppers of Section R903.4.1 to be added to an existing roof.

Reason: : IRC 2006 and subsequent editions include a requirement in Section R903.4-Roof Drainage that for roof drainage systems with roof drains or scuppers, secondary (emergency overflow) drains or scuppers also be provided in the event the primary roof drainage systems becomes clogged.

Section R907.1-Reroofing requires all materials and methods used in re-covering or replacing an existing roof covering comply with the requirements of Chapter 9 (except the minimum roof slope requirement of ¼:12 can be waived for roofs that provide "…positive roof drainage."). This statement can be interpreted to require the secondary (emergency overflow) drains and scupper provision also apply in reroofing. Since many existing buildings were designed and constructed before the code included a secondary requirement, the secondary drainage provision being applicable in reroofing and the need for adding secondary drains in existing buildings during reroofing can be a very costly and disruptive undertaking for owners and occupants.

This proposed code change adds an exception to Section R907.1-Reroofing that waives the secondary drainage requirement when reroofing existing buildings when the roof drains properly, that being provides positive drainage as is defined by the Code.

This same code change proposal was submitted for the International Building Code as S60-12 in Group A and was Approved as Modified by Public Comment 2. This proposal includes the AMPC2 language.

Cost Impact: The code change proposal will not increase the cost of construction.

RB451-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907.1-RB-GRAHAM.doc

RB452 – 13
R907.3, R907.4, R907.5, R907.6

Proponent: Andy Williams, Metal Construction Association (afwilliams@metalconstruction.org)

Revise as follows:

R907.3 Fire classification. The roof covering fire classification shall not be reduced due to repairs from the fire classification required when installed. The roof covering fire classification for a recovering shall comply with the fire classification in Section R902.

~~**R907.3**~~ **R907.4 Recovering versus replacement.** New roof coverings shall not be installed without first removing all existing layers of roof coverings where any of the following conditions exist:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Installation of metal panel, metal shingle and concrete and clay tile roof coverings over existing wood shake roofs shall be permitted when the application is in accordance with Section R907.5.
3. The application of new protective coating over existing spray polyurethane foam roofing systems shall be permitted without tear-off of existing roof coverings.
4. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

~~**R907.4**~~ **R907.5 Roof recovering.** Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other *approved* materials securely fastened in place.

~~**R907.5**~~ **R907.6 Reinstallation of materials.** Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Any existing flashings, edgings, outlets, vents or similar devices that are a part of the assembly shall be replaced when rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

~~**R907.6**~~ **R907.7 Flashings.** Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Reason: Section R907.3 is added to clarify that the roof covering is required to comply with the fire classification mandated by the IRC. For repairs to a roof covering, the repairs are required to maintain the roof covering fire classification required by the IRC when the roof covering was initially installed. For a recovering, the roof covering is required to have the fire classification required by the IRC adopted at the time of the recovering.

Cost Impact: The code change proposal will not increase the cost of construction.

RB452-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907.3 (NEW)-RB-WILLIAMS.doc

RB453– 13
R907.3, R907.3.1 (NEW), R907.3.1.1 (NEW)

Proponent: Michael D. Fischer, Kellen Company, representing the Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

Revise as follows:

~~**R907.3 Recovering versus replacement.** New roof coverings shall not be installed without first removing all existing layers of roof coverings where any of the following conditions exist:~~

1. ~~Where the existing roof or roof covering is watersoaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.~~
2. ~~Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.~~
3. ~~Where the existing roof has two or more applications of any type of roof covering.~~

~~**Exceptions:**~~

1. ~~Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.~~
2. ~~Installation of metal panel, metal shingle and concrete and clay tile roof coverings over existing wood shake roofs shall be permitted when the application is in accordance with Section R907.4.~~
3. ~~The application of new protective coating over existing spray polyurethane foam roofing systems shall be permitted without tear-off of existing roof coverings.~~
4. ~~Where the existing roof assembly includes an ice barrier membrane that adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.~~

R907.3 Roof replacement. Roof replacement shall include the removal of all existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

R907.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturers approved installation instructions
2. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section R907.4.
4. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

R907.3.1.1 A *roof recover* shall not be permitted where any of the following conditions occur:

1. <u>Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.</u>
2. <u>Where the existing roof covering is slate, clay, cement or asbestos-cement tile.</u>
3. <u>Where the existing roof has two or more applications of any type of roof covering.</u>

Reason: The intent of this proposal is to clarify the requirements for roof recover and roof replacement. In the new Section R907.3, the requirements for roof replacement (and the exception for ice barrier membranes) remain intact. The new Section R907.3.1 provides a much clearer path to identify those conditions where recover is permitted by the code. The current provisions for roof recover remain intact, except for two technical changes:

1. The current code contains a conflict related to the covering of wood shakes. The public comment provides a remedy by eliminating the prohibition contained in the text, which is in conflict with the application in accordance with Section R907.4.

2. The code lists several prescriptive options for recover, but does not specifically provide for other conditions where products have been evaluated for recover applications. The proposal includes that option, but requires installation in accordance with the manufacturer's instructions.

Cost Impact: The code change proposal will not increase the cost of construction.

RB453-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907.3-RB-FISCHER.doc

RB454 – 13
R907.3

Proponent: Andrew Herseth, US Dept of Homeland Security, representing Federal Emergency Management Agency (FEMA) and Glenn Overcash, URS Corporation representing FEMA

Revise as follows:

R907.3 Recovering versus replacement. New roof coverings shall not be installed without first removing all existing layers of roof coverings where any of the following conditions exist:

1. Where the existing roof or roof covering is watersoaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.
4. Where the existing roof covering is asphalt shingles and the new roof covering is asphalt shingles and where wind design is required in accordance with Section R301.2.1.1.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Installation of metal panel, metal shingle and concrete and clay tile roof coverings over existing wood shake roofs shall be permitted when the application is in accordance with Section R907.4.
3. The application of new protective coating over existing spray polyurethane foam roofing systems shall be permitted without tear-off of existing roof coverings.
4. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

Reason: Removing the existing roof covering allows the roof deck to be inspected for deterioration and adequacy of attachment. Also, in the case of asphalt shingles, installation of new shingles over existing decreases the likelihood that the new shingles will be fully sealed because of substrate variation caused by the old shingles. Intermittent bonding of new shingles installed over existing has been observed by FEMA Mitigation Assessment Teams (MAT) deployed after Hurricanes Charley (FL, 2004), Ivan (2004), Katrina (LA and MS, 2005) and Ike (TX, 2008). All of the damaged roofs were located in areas where the basic wind speed is greater than 110 mph [ASCE 7-05 3-second gust per Figure R301.2(4)A]. MAT observations are documented in FEMA publications 488, 489, 549 and P-757.

This code change proposal seeks to require tear-off of existing roofs when re-roofing in high wind areas, and it clearly defines "high wind".

As a "best practice" FEMA P-499, *Home Builder's Guide to Coastal Construction* (FEMA, 2010) and P-804, *Wind Retrofit Guide for Residential Buildings* (FEMA, 2010) recommend that the existing roof covering be torn-off rather than roofed over where the basic wind speed is greater than 90 mph [ASCE 7-05 3-second gust per Figure R301.2(4)A]. However, as a code minimum, only areas with a basic wind speed of 110 mph [ASCE 7-05 3-second gust] or higher are proposed, which is consistent with the shaded area in Figure R301.2(4)B that stipulates where wind design is required. The Insurance Institute for Business and Home Safety (IBHS) *Fortified* publications also recommend tear-off rather than recover.

Cost Impact: The code change proposal will increase the cost of construction associated with a limited set of re-roofing projects.

RB454-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R907.3-RB-HERSETH-OVERCASH.doc

RB455 – 13
R1002.2, R1002.5, Chapter 44

Proponent: Timothy N. Seaton, B.S.C.E., Empire Masonry Heaters LLC (tseaton@timelyconstruction.com)

Revise as follows:

1002.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E 1602; or
2. Masonry heaters shall be *listed* and labeled in accordance with UL 1482 <u>or EN 15250</u> and installed in accordance with the manufacturer's installation instructions.

1002.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (765 mm) of the outside surface of a masonry heater in accordance with NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. When the masonry heater wall thickness is at least 8 inches (203 mm) thick of solid masonry and the wall thickness of the heat exchange channels is at least 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters *listed* and labeled in accordance with UL 1482 <u>or EN 15250</u> and installed in accordance with the manufacturer's instructions.

Add new standard to Chapter 44 as follows:

<u>**EN European Committee for Standardization (EN)**</u>
<u>**Central Secretariat**</u>
<u>**Rue de stassart 36**</u>
<u>**B-10 50 Brussels**</u>

<u>EN 15250 Slow Heat Release Appliances Fired By Solid Fuel. Requirements And Test Methods.</u>

Reason: This proposal harmonizes IRC Section 1002 with the corresponding 2013 IBC Section 2112.

UL 1482, *Solid-Fuel Type Room Heaters*, was created to evaluate wood stoves and similar appliances. It does not address thermal mass storage devices of masonry construction such as masonry heaters and contains significant deficiencies in evaluating them. Specifically, UL 1482 stipulates fueling the appliance until temperature equilibrium is reached at which point the safety clearances are verified. This is not an appropriate end of test for masonry heaters and cannot in testing application actually be clearly reached. While UL 1482 may eventually be modified to specifically address masonry heaters, in 2007 the European standard EN 15250, *Slow heat release appliances fired by solid fuel. Requirements and test method,* was finalized specifically to address masonry heaters and similar devices and has since been adopted by 37 countries in Europe and elsewhere. Since Europe is the original source of virtually all masonry heater technology and since IBC already references European Union standards elsewhere, it is appropriate to reference this standard here. EN 15250 stipulates the same allowable temperature elevations of adjacent combustible materials as UL 1482 but uses an appropriate test fueling method.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, EN 15250 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB455-13

Public Hearing: Committee:	AS	AM	D

Assembly: ASF AMF DF

R1002.2-RB-SEATON.doc

RB456 – 13
R1002.5

Proponent: Timothy N. Seaton, B.S.C.E., Empire Masonry Heaters LLC (tseaton@timelyconstruction.com)

Revise as follows:

1002.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) <u>or the distance of the allowed reduction method</u> ~~of~~ <u>from</u> the outside surface of a masonry heater in accordance with NFPA 211, Section ~~8-7 (clearances for solid fuel-burning appliances)~~ <u>12.6, Clearances from Solid Fuel-Burning Appliances</u>, and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. When the masonry heater wall is at least 8 inches (203 mm) thick of *solid masonry* and the wall of the heat exchange channels is at least 5 inches (127 mm) thick of *solid masonry*, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 may be installed in accordance with the listing specifications and the manufacturer's written instructions.

Reason: This proposal harmonizes IRC Section 1002 with the corresponding 2013 IBC Section 2112.
1) Metric conversion is incorrect; 2) NFPA 211 citation is incorrect; and 3) NFPA 211 Section 12.6 allows clearances under 36" with stipulated distance reduction strategies.

Cost Impact: The code change proposal will not increase the cost of construction.

RB456-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1002.5 #1-RB-SEATON.doc

RB457 – 13
R1002.5, Chapter 44

Proponent: Timothy N. Seaton, B.S.C.E.; Empire Masonry Heaters LLC (tseaton@timelyconstructon.com)

Revise as follows:

1002.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (765 mm) of the outside surface of a masonry heater in accordance with NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. When the masonry heater <u>is unlisted</u> ~~wall thickness is at least 8 inches (203 mm) thick of solid masonry and the wall thickness of the heat exchange channels is at least 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.~~ <u>clearances shall conform to TRVB 105.</u>
2. <u>When</u> masonry heaters <u>are</u> *listed* and labeled in accordance with UL 1482 ~~maybe~~ <u>and</u> installed in accordance with the ~~listing, specifications and~~ manufacturer's ~~written~~ instructions<u>, clearances shall be as listed</u>.

Add new standard to Chapter 44 as follows:

<u>TRVB 105 – Fireplaces for Solid Fuels</u>

Reason: Make masonry heater clearances safe and rational!

North American masonry heater technology is virtually all sourced in Europe where the devices have been built for centuries. In conformance with typical European standards, ASTM E1602, *Standard Guide for Construction of Solid Fuel Burning Masonry Heaters,* does not stipulate masonry heater wall thickness nor relate it to clearances to combustibles. In contrast to masonry fireplace construction and operation, masonry heater wall thickness is not the critical design feature but instead <u>material thermal conductivity.</u> Greater wall thicknesses actually create a more dangerous situation by creating more thermal storage with eventual radiation.

<u>Heat storing masonry heaters are being designed and installed at the same clearances as fireplaces which are not designed to store heat.</u> Until recent IBC and IRC code revisions, all minimum masonry heater clearances were 4" (102 mm) to surface wall or protective shield as per ASTM E1602. Although I can locate no documented examples of wall ignition from masonry heaters of any wall thickness at this clearance:

1. <u>no European country allows this low of a clearance for any masonry heater without testing and listing or a safety shielding strategy for clearance reduction.</u>
2. <u>no UL 1482 testing exists for any masonry heater with this low of a clearance.</u>
3. <u>ASTM E1602 mentions safety shielding but gives no prescription for use.</u>
4. TRVB 105 remedies this by establishing greater safety clearances and outlining reduction strategies.

In the recent IBC/IRC code revision "NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances)" (*sic)* was made a ruling standard for masonry heater clearances instead of ASTM E1602:

1. <u>this standard was created for wood stoves and similar appliances and not masonry heaters.</u>
2. <u>no European country stipulates masonry heater clearances to combustibles anywhere near 36"</u>.
3. <u>UL 1482 masonry heater testing is not yielding clearances anywhere near 36"</u>.
4. <u>NFPA 211 has recently moved masonry heaters from the chapter on solid fuel burning appliances to their own chapter, recognizing the difference in the devices.</u>

The typical masonry heater sold is custom in design and cannot support laboratory safety testing. We cannot expect that such units will be listed. TRVB 105 is a consensus document from the experts in the technology and is the more conservative of such European standards.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, TRVB 105 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2012.

RB457-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1002.5 #2-RB-SEATON.doc

RB458 – 13
R1003.18

Proponent: Jim Buckley, Buckley Rumford Co. representing Masonry Alliance for Codes and Standards and Clay Lining Institute (buckley@rumford.com)

Revise as follows:

R1003.18 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum air space clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum air space clearance of 1 inch (25 mm). The air space shall not be filled, except to provide fire blocking in accordance with Section R1003.19.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and *labeled* for use in chimneys in contact with combustibles in accordance with UL 1777 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding and flooring, shall be permitted to abut the masonry chimney side walls, in accordance with Figure R1003.18, provided such combustible trim or sheathing is a minimum of ~~12 inches (305 mm)~~ <u>8 inches (203 mm)</u> from the inside surface of the nearest flue lining. ~~Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).~~

Reason: Tests have shown that the currently required 12" chimney wall thickness for the chimney to be in contact with combustible trim is overly restrictive. Chimneys with enclosing walls of 8" in contact with combustible material are at least as safe as the current basic code requiring chimneys to have 4" thick solid masonry walls two inches clear of combustibles. This change would provide for timber frame or wood ceilings to safely abut a masonry chimney.

Eight Inch Chimney Wall Test
In support of Buckley Code Change Proposal R1003.18 - 9/20/12

Purpose of test: To determine if a chimney built so that the clay flue liner is enclosed with 8" of solid masonry in contact with combustible materials is as safe as the current code requirement that the clay flue liner be enclosed with 4" of solid masonry plus 2" of air space to combustible materials.

We conclude that building chimney walls 8" thick in contact with combustible materials is at least as safe as building chimneys with 4" thick walls 2" clear of combustible materials which is current code.

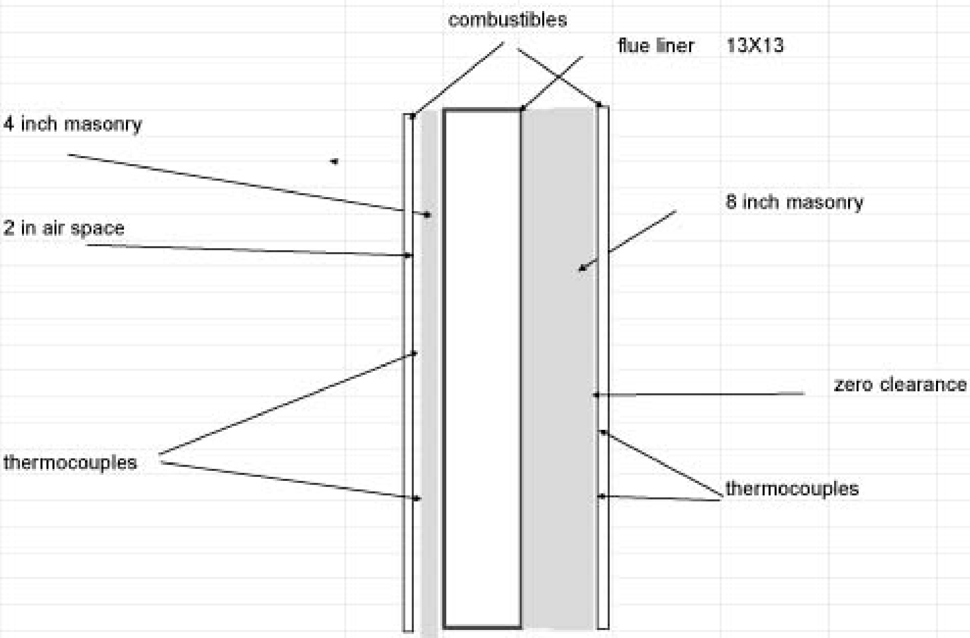
Method: To build a masonry chimney with one side built to code - 4" thick wall plus 2" of air space to combustibles - and the opposite side built 8" thick in contact with combustibles and subject the chimney to flue gas temperatures representing an over fire or chimney fire condition. If the combustibles in contact with the 8" thick masonry did not become as hot as the combustibles 2" clear of a 4" thick masonry chimney wall (the code compliant condition) we can conclude that a chimney with 8" thick walls in contact with combustibles is at least as safe as the code compliant chimney with 4" walls plus a 2" air space to combustibles.

Results:

The combustibles on the code compliant side - 4" thick wall plus 2" of air space to combustibles - reached 90 deg.F above ambient temperature after four hours at a flue gas temperature of 1,000 deg. F while the combustibles in contact with the 8" thick side made it to five hours before reaching 90 degrees above ambient. By that time the combustibles on the code compliant side had reached 45 deg.F above the 90 deg.F above ambient failure temperature.

sept 14 2012 chimney test

4 inch brick with 2 inch air space versus 8 inch brick zero clearance



Time	flue	flue	zero	zero	zero	2 inch	2 inch	2 inch	ambient
start	71	71	66	66	66	66	66	66	56
1 hour	1000	1008	66	66	66	66	71	74	56
2 hr	1000	1005	85	78	79	94	102	111	56
3 hr	1001	992	111	102	104	127	132	137	58
4 hr	1001	993	147	142	142	168	165	175	57
5 hr	1002	995	144	160	168	200	201	197	74
6 hr	1000	992	167	170	170	220	226	227	78
7 hr	1000	992	191	194	197	230	232	236	83
8 hr	1002	995	203	202	205	231	231	240	83
1 hour of cooling time	387	423	217	220	220	211	215	214	85
temps declined after this point									

Test #2 Sept 19, 2012
1 Hr to heat chimney to 1400 then held for 3 hrs at 1400 then spiked to 2100 for 10 min cooled 1 hr and repeated twice

Time									
start	47	49	52	49	51	51	52	49	47
1 hour	1400	1338	52	53	53	71	71	76	52
2 hour	1403	1358	61	62	65	137	142	143	55
3 hour	1403	1355	87	94	101	208	215	218	61
4 hour	1401	1357	127	125	119	243	236	222	60
10 min hold at 2100	2100	1911	107	113	114	236	242	221	61
after 1 hour cool	702	693	136	143	147	235	241	248	64
10 min hold at 2100	2100	1928	131	135	137	239	241	248	62
after 1 hr cool	637	714	135	138	143	229	268	270	64
10 min hold at 2100	2073	1962	127	127	136	218	257	255	64
peak temp during2 1/2 hr cooling	329	406	139	139	180	206	287	288	63

Cost Impact: The code change proposal will not increase the cost of construction, it would reduce the cost.

RB458-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1003.18-RB-BUCKLEY.doc

RB459 – 13
R1004.5 (NEW)

Proponent: Bob Eugene, Underwriters Laboratories Inc, UL (robert.eugene@ul.com), David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Add new text as follows:

R1004.5 Gasketed fireplace doors. A gasketed fireplace door shall not be installed on a factory-built fireplace except where the fireplace system has been specifically tested, *listed* and *labeled* for such use in accordance with UL 127.

Reason:
(Eugene) Consistent with action on Proposal M163-12 in Group A codes.

(Hall) Because of requirements in the IECC that require all fireplaces to be provided with gasketed doors, a great deal of controversy has resulted. Most factory-built fireplaces are not tested for use with sealed glass doors and installing such doors on fireplaces that are not tested for these doors could cause overheating of the fireplace resulting in a fire hazard. Without testing, the effect of the doors will be an unknown. This text was approved for the 2015 IMC.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC) The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB459-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1004.5 (NEW)-RB-EUGENE-HALL.doc

RB460 – 13
R1005.2

Proponent: Jim Buckley, Buckley Rumford Co., representing Masonry Alliance for Codes and Standards and Clay Lining Institute (buckley@rumford.com)

Revise as follows:

R1005.2 Decorative shrouds. Decorative shrouds shall not be installed at the termination of factory-built chimneys except where the shrouds are *listed* and *labeled* for use with the specific factory-built chimney system and installed in accordance with the manufacturer's installation instructions <u>or comply with Section R1003.9</u>.

Reason: It is impractical to test each custom decorative shroud with every listed chimney system so the manufacturers of the various UL listed chimney systems have added "supplementary instructions" to provide minimum dimensions and construction guidelines that are written in prescriptive language that is similar to that already in Section R1003.9 of the code. Individual home builders and manufacturers of chimney rain caps, spark arrestors, chimney caps or shrouds should not have to list their decorative shrouds as long as they meet the requirements set forth in Section R1003.9. This change would not prevent the use of listed decorative shrouds but it would provide for a safe way to install custom decorative shrouds - unlisted by complying with code.

Cost Impact: The code change proposal will not increase the cost of construction, it will reduce the cost.

RB460-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1005.2-RB-BUCKLEY.doc

RB461 – 13
R1006.2, R1006.5

Proponent: David Hall CFM, Georgetown Texas representing the ICC PMG Code Action Committee (dave.hall@georgetown.org)

THIS CODE CHANGE WILL BE HEARD BY THE IRC-PLUMBING/MECHANICAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEE.

Revise as follows:

R1006.2 Exterior air intake. The exterior air intake shall be capable of supplying all *combustion air* from the exterior of the *dwelling* or from spaces within the *dwelling* ventilated with ~~outside~~ outdoor air such as nonmechanically ventilated crawl or *attic* spaces. The exterior air intake shall not be located within the garage or *basement* of the *dwelling.* ~~nor~~ The exterior air intake, for other than listed factory-built fireplaces, shall not ~~the air intake~~ be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of $1/4$-inch (6 mm) mesh.

R1006.5 Outlet. ~~Locating the exterior air outlet in the back or sides of the firebox chamber or within 24 inches of the firebox opening on or near the floor is permitted.~~ The exterior air outlet shall be located in the back or side of the firebox chamber or shall be located outside of the firebox, at the level of the hearth and not greater than 24 inches (610mm) from the firebox opening. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

Reason: The requirement that the exterior air intake not be located higher than the firebox appears to conflict with Section R1006.1.1 which simply defers the installation to the fireplace manufacturer's instructions. The proposed revision makes this requirement applicable only to masonry fireplaces. If the exterior air intake was not allowed to be higher than the firebox, listed factory-built fireplaces could not be installed in basements or the lower levels of split level homes. The only way around this appears to be the case where the air outlet is installed outside of the firebox as allowed in Section R1006.5, thus negating the concern for fire and hot gases entering the exterior air duct. (this hazard is not possible if the outlet in not within the firebox).
The revision to Section R1006.5 simply cleans up language and eliminates subjective text. The current first sentence does not require anything, rather, it offers some things that you are allowed to do. The location text "on or near the floor" is subjective. The intent is simply at the same level as the hearth, so, the outlet could be in the floor or in a wall at the intersection of the floor and wall.

This proposal is submitted by the ICC Plumbing, Mechanical and Fuel Gas Code Action Committee (PMGCAC). The PMGCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the PMGCAC has held 2 open meetings, multiple conference calls and multiple workgroup calls which included members of the PMGCAC. Interested parties also participated in all of the meetings and conference calls to discuss and debate the proposed changes.

Cost Impact: The code change proposal will not increase the cost of construction.

RB461-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

R1006.2-RB-HALL-PMGCAC

RB462 – 13
Appendix F

Proponent: Rick Davidson, City of Maple Grove, Association of Minnesota Building Officials (rdavidson@maplegrovemn.gov)

Revise as follows:

APPENDIX F
~~RADON CONTROL METHODS~~
PASSIVE RADON GAS CONTROLS
(The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.)

SECTION AF101
SCOPE

AF101.1 General. This appendix contains requirements for new construction in *jurisdictions* where radon-resistant construction is required. These requirements are intended to provide a passive means of resisting radon gas entry and prepare the dwelling for post-construction radon mitigation, if necessary (see Figure AF102). Active construction techniques may be used in lieu of passive techniques where approved.

Inclusion of this appendix by *jurisdictions* shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1).

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.

ENCLOSED CRAWL SPACE. A crawl space that is enclosed with foundation walls that may include windows, doors, access openings, and required vents.

GAS-PERMEABLE LAYER. A gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate that is not less than 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill) that is not less than 4 inches (102 mm) thick and that is overlain by a soil gas collection mat or soil gas matting installed in accordance with the manufacturer's installation instructions.

RADON GAS. A naturally occurring, chemically inert, radioactive gas ~~that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.~~

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene ~~or other equivalent material~~ used to retard the flow of soil gases into a ~~building~~ dwelling.

SUBMEMBRANE DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower submembrane air pressure relative to basement or crawl space air pressure by use of a vent pipe drawing air from beneath the soil-gas-retarder membrane.

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Active).** A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.~~

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe ~~routed through the *conditioned space* of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab~~ drawing air from beneath concrete floor slabs or other floor assemblies that are in contact with the ground.

VENT PIPE. Not less than a 3-inch diameter (76 mm) ABS or PVC gastight pipe extending from the gas permeable layer through the roof.

SECTION AF103
~~REQUIREMENTS~~
PASSIVE RADON RESISTANT SYSTEM REQUIREMENTS

AF103.1 General. ~~The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary (see Figure AF102). These techniques are required in areas where designated by the *jurisdiction*.~~ The following components of a passive submembrane or subslab depressurization system shall be installed during construction.

~~**AF103.2 Subfloor preparation.** A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a subslab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:~~

1. ~~A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.~~
2. ~~A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.~~
3. ~~Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.~~

~~**AF103.3 Soil-gas-retarder.** A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly, and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.~~

~~AF103.4~~ AF103.2 Entry routes. Potential radon entry routes shall be closed in accordance with Sections ~~AF103.4.1~~ AF103.2.1 through ~~AF103.4.10~~ AF103.2.8.

~~AF103.4.1~~ AF103.2.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs~~,~~ or other floor assemblies~~,~~ shall be filled with a polyurethane caulk~~,~~ or expanding foam ~~or equivalent sealant~~ applied in accordance with the manufacturer's ~~recommendations~~ installation instructions.

~~**AF103.4.2 Concrete joints.** All control joints, isolation joints, construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.~~

~~**AF103.4.3 Condensate drains.** Condensate drains shall be trapped or routed through nonperforated pipe to daylight.~~

~~**AF103.4.4**~~ **AF103.2.2 Sumps.** Sumps ~~pits~~ open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or ~~otherwise~~ sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

~~**AF103.4.5**~~ **AF103.2.3 Foundation walls.** Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above ~~finished ground surface~~ grade ~~to prevent the passage of air from the interior of the wall into the living space~~. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be ~~sealed~~ solid masonry, one course of masonry grouted solid, or a solid concrete beam. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of ~~masonry block or wood~~ foundation walls below ~~the ground surface~~ grade shall be filled with polyurethane caulk ~~or equivalent sealant~~. ~~Penetrations of concrete walls shall be filled.~~

~~**AF103.4.6**~~ **AF103.2.4 Dampproofing.** The exterior surfaces of ~~portions of~~ ~~concrete and masonry block~~ foundation walls below ~~the ground surface~~ grade shall be dampproofed in accordance with Section R406.

~~**AF103.4.7**~~ **AF103.2.5** ~~**Air-handling units**~~ **Air-conditioning systems.** ~~Air-handling units~~ Entry points, joints, or other openings into air conditioning systems in enclosed crawl spaces shall be sealed ~~to prevent air from being drawn into the unit~~.

> **Exception:** ~~Units~~ Systems with gasketed seams or ~~units~~ that are otherwise sealed by the manufacturer ~~to prevent leakage~~.

~~**AF103.4.8**~~ **AF103.2.6 Ducts.** Ductwork passing through or beneath a slab within a dwelling shall be of seamless material unless the ~~air-handling~~ air-conditioning system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed ~~to prevent air leakage~~.

Ductwork located in enclosed crawl spaces shall have all seams and joints sealed by closure systems in accordance with Section M1601.4.1.

~~**AF103.4.9 Crawl space floors.** Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.~~

~~**AF103.4.10**~~ **AF103.2.7 Crawl space access.** Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or ~~otherwise filled to prevent air leakage~~ sealed.

~~**AF103.5 Passive submembrane depressurization system**~~ **AF103.3 Basements or enclosed crawl spaces with soil floors.** In ~~buildings~~ dwellings with basements or enclosed crawl spaces ~~foundations~~ with soil floors, the following components of a passive submembrane depressurization system shall be installed during construction.

> **Exception:** ~~Buildings in which an *approved* mechanical crawl space ventilation system or other equivalent system is installed.~~ Basements or enclosed crawl spaces that are provided with a continuously operated mechanical exhaust system in accordance with Section R408.3.

~~**AF103.5.1 Ventilation.** Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section R408.1.~~

~~**AF103.5.2**~~ **AF103.3.1 Soil-gas-retarder.** The soil in basements and enclosed crawl spaces shall be covered with a ~~continuous layer of minimum 6- mil (0.15 mm) polyethylene~~ soil-gas-retarder. The ~~ground cover~~ soil-gas-retarder shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the basement or crawl space ~~area~~. The soil-gas-retarder shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

~~**AF103.5.3 Vent pipe**~~ **AF103.3.2 "T" fitting and vent pipe.** ~~A plumbing tee or other *approved* connection~~ A 3- or 4-inch "T" fitting shall be inserted ~~horizontally~~ beneath the ~~sheeting~~ soil gas retarder ~~and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting~~ and be connected to a vent pipe. The vent pipe shall ~~be extended up through the building floors,~~ extend through the conditioned space of the dwelling and terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point~~, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings~~.

~~**AF103.6**~~ **AF103.4** ~~**Passive subslab depressurization system**~~ **Basements or enclosed crawl spaces with concrete floors or other floor systems and slab on grade dwellings.** ~~In *basement* or slab-on-grade buildings, the~~ The following components of a passive subslab depressurization system shall be installed during construction in slab on grade dwellings or in dwellings with basements or crawl spaces with concrete or other floor systems.

AF103.4.1 Sub-slab preparation. A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the dwelling.

AF103.4.2 Soil-gas-retarder. A soil gas retarder shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly. The soil-gas-retarder shall cover the entire floor area with separate sections lapped at least 12 inches (305 mm). The soil-gas-retarder shall fit closely around any pipe, wire, or other penetrations of the material. All punctures or tears in the material shall be sealed or covered.

~~**AF103.6.1**~~ **AF103.4.3** ~~**Vent pipe**~~ **"T" fitting and vent pipe.** ~~A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gas-tight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.~~

~~The pipe shall be extended up through the building floors, and terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.~~ Before a slab is cast or other floor system is installed, a "T" fitting shall be inserted below the slab or other floor system and the soil-gas-retarder. The "T" fitting shall be connected to a vent pipe. The vent pipe shall extend through the conditioned space of the dwelling and terminate not less than 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point.

AF103.5 Drain tile and sump used for depressurization. As an alternative to inserting a vent pipe into a "T" fitting, a vent pipe shall be permitted to be inserted directly into an interior perimeter drain tile loop or through a sump cover where the drain tile and/or sump is exposed to the gas permeable layer.

~~AF103.6.2~~ AF103.6 Multiple vent pipes. In ~~buildings~~ dwellings where interior footings or other barriers separate the ~~subslab aggregate or other~~ gas-permeable ~~material~~ layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.7 Combination foundations. Where basement or crawl space floors are on different levels, each level shall have a separate vent pipe. Multiple vent pipes may be connected to a single vent pipe that terminates above the roof.

~~AF103.7~~ AF103.8 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the ~~slab or~~ soil-gas-retarder.

~~**AF103.8 Vent pipe accessibility.** Radon vent pipes shall be accessible for future fan installation through an *attic* or other area outside the *habitable space*.~~

~~**Exception:** The radon vent pipe need not be accessible in an *attic* space where an *approved* roof-top electrical supply is provided for future use.~~

AF103.9 Vent pipe identification. All exposed and visible interior ~~radon~~ vent pipes shall be identified with at least one *label* on each floor and in accessible *attics*. The *label* shall read: “Radon Reduction System.”

~~**AF103.10 Combination foundations.** Combination *basement*/ crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.~~

~~**AF103.11 Building depressurization.** Joints in air ducts and plenums in un*conditioned spaces* shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.~~

~~AF103.12~~ AF103.10 Power source and access for future radon fan. To provide for future installation of ~~an active submembrane or subslab depressurization system~~ a radon fan, an electrical circuit terminated in an *approved* box shall be installed during construction in the ~~*attic* or other~~ anticipated location of ~~vent pipe~~ the radon fans. ~~An electrical supply shall also be accessible in anticipated locations of system failure alarms.~~ An accessible clear space 24 inches in diameter by 3 feet in height adjacent to the vent pipe shall be provided at the anticipated location of a future radon fan.

Reason: First is it important to point out that the current radon rules only require a “passive” system. The current rules do not require a radon fan and do not regulate fans or “active” systems when they are installed. This proposal does not change that.

Second, there may be flaws in the existing language other than what are pointed out here. For example, current code language does not address some of the fine points of installing a soil-gas-retarder. Someone with greater expertise will need to correct those problems in subsequent code changes if they believe it is necessary.

And third, these rules have gone unchanged since being placed in the appendix of the 2000 IRC. Because they are in the appendix and because they are very infrequently adopted, they have not received the attention they might otherwise have had if they had been in the main body of the code. For those jurisdictions that have had the misfortune of having to enforce radon rules, they have proven problematic because the current rules are not well written and include conflicts, repetitive language, and vagaries. This proposal is intended to rearrange the sections in a more logical manner, create new definitions, delete unnecessary and repetitive language, and eliminate conflicts.

What follows is a section by section explanation of the revisions that are proposed.

APPENDIX F
~~RADON CONTROL METHODS~~
PASSIVE RADON GAS CONTROLS

(The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.)

__Reason:__ The proposed title revision is intended to make clear that this appendix chapter only requires "passive radon controls".

SECTION AF101
SCOPE

AF101.1 General. This appendix contains requirements for new construction in *jurisdictions* where radon-resistant construction is required. These requirements are intended to provide a passive means of resisting radon gas entry and prepare the dwelling for post-construction radon mitigation, if necessary (see Figure AF102). Active construction techniques may be used in lieu of passive techniques when approved.

Inclusion of this appendix by *jurisdictions* shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1).

__Reason:__ The language added to the Scope has been relocated from AF103.1. It seems more appropriate to have this explanatory language in the scope. It further explains that "Active" systems are permitted when approved. There is no attempt here to provide any direction on an appropriate active system since there is none in the current rule.

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.

ENCLOSED CRAWL SPACE. A crawl space that is enclosed with foundation walls that may include windows, doors, access openings, and required vents.

__Reason:__ This definition is necessary because the term "crawl space" is frequently used in the section but there is no differentiation between an enclosed and unenclosed crawl space. The presumption here is that a crawl space that is open to the exterior (ex. dwelling constructed on piers) does not pose a risk from radon gas. The application proposed in this revision is that we are only concerned with enclosed crawl spaces.

GAS-PERMEABLE LAYER. A gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate that is a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill) that is a minimum of 4 inches (102 mm) thick and that is overlain by a soil gas collection mat or soil gas matting installed in accordance with the manufacturer's installation instructions.

__Reason:__ Rather than frequent repetition of what constitutes a gas-permeable layer, a definition is proposed. This language is taken from AF103.2. Furthermore, the term "geotextile drainage matting" is replaced with "soil gas collection mat or soil gas matting" which is the term found in the EPA handbook entitled "Build Radon Out". An internet search of those terms will result in many "hits".

A. Gas Permeable Layer

Usually a 4-inch layer of clean, coarse gravel is used beneath the slab to allow the soil gas to move freely underneath the house. Other options are to install a loop of perforated pipe or soil gas collection mat (also known as drainage mat or soil gas matting).

Additionally, it is proposed that soil gas collection mats be installed in accordance with the manufacturer's installation instructions. The following link is an example of the installation instructions for this particular product indicating that there is significant detail and direction given.
http://www.radon.biz/soilgascollectormattingpriceperrollcomesin45footrolls.aspx

Placing the Mat
1. Lay out the Soil Gas Collector (SGC) on the sub grade after the final preparation and before the concrete is poured. It is typically laid out in a rectangular loop in the largest area with branches or legs into the smaller areas.
2. Position the "T-Riser" in appropriate location and nail down with a 12-inch spike through hole in center.
3. Slide the SGC into openings in "T-Riser" with a portion of the fabric around the outside. Tape the fabric to the outside of the "T-Riser" with duct tape and staple the SGC to the ground with a landscaping staple near the "T-Riser"
4. Roll out the SGC, smooth it onto the ground. To avoid wrinkles and buckling, work away from the '"T-Riser", stapling it to the ground as you go. The SGC should be stapled to the ground every three to four feet, in addition to the corners, "tee's" and ends.

5. Corners are constructed by peeling back the filter fabric, cutting the two ends of the SGC matrix at 45 angles and butting (or overlap no more than 1\2 inch) the matrix together. Pull the filter fabric back and tape into place. Staple across the joint of the matrix and each leg of the corner. Use a minimum of four staples at each corner - two across the joint and one on each leg.
6. The "tees" for branches or legs are constructed by slitting the fabric of the main loop at the location desired. Cut the fabric of branch at the edges and expose 2 inches of the matrix. Cut off the exposed matrix and butt the matrix of the branch (or overlap no more than 1\2 inch) to the matrix of the main loop. Pull the filter fabric of the branch back over the main loop and tape into place. Staple across the joint of the matrix with two staples and one each on the branch and the main loop. Use a minimum of four staples at each "tee"- two across the joint and one on each on the loop and branch
7. All openings in the fabric at joints, "tee's and ends of the branches should be taped to keep out the concrete.
8. When the building is ready for the soil gas vent pipe to be installed, the top of the "T-Riser" is cut off and a four-inch pipe is inserted, caulked with polyurethane and secured with screws. The vent pipe should be labeled to avoid confusion with the plumbing pipes.
Note: The openings in the riser are laid out at 180 to accommodate straight runs of the SGC only. If the riser is to be located in a corner, which is Not uncommon, the front of the "tee" can be cut off and the SGC inserted into the new opening. The side of the "tee" which will not be used should be sealed with duct tape. This creates a "90 tee" which will allow the riser to be placed in a corner with either end of the SGC loop running into the "tee" at a 90 angle.
Pouring Concrete:
The filter fabric that comes sewn around the soil gas collector prevents the wet concrete from entering the mat and reducing its air collection capacity. The only precaution that needs to be taken is that the fabric is duct tape closed at seams of splices and corners sufficiently to keep the uncured concrete from entering.
The mat also needs to be secured to the soil with landscape staples to prevent the concrete from lifting it off the soil while it is being applied. Reinforcing bars and wire can be laid right on top of the mat.
Note that the mat is strong enough to withstand concrete workers and their wheelbarrows as they cross over it during the course of installing the slab.
Riser has special hole and spike for securing it in place.
Making Corners and Splices
The mat should be routed around the inside perimeter of the foundation. This will require an occasional corner. Furthermore, splices will have to be made to join two lengths of mat together. Corners and splices are very easy to make, and do not require any special fittings. Cut back the filter fabric to expose the core material. In the case of a splice merely overlap the core by at least one corrugation replace the cloth and tape it. Use two landscape staples to hold the splice in place. In the case of a corner slice the core of two adjoining legs of the mat at 45-degree angles, overlap the edges by one corrugation, tape the cloth and landscape staple together. The corner is illustrated below:
Cut back the cloth. Cut the core at a 45 degree angle. Overlap corrugations
Replace filter cloth. Duct tape edges to keep out concrete. Staple in place.
Connecting The Mat To The Riser
A convenient riser with a dual entry allows for either end of the loop of mat to be secured to the soil gas vent riser. Slide the mat into either end of the riser and tape the edge to prevent wet concrete from entering.
The riser comes with a molded cap to keep out concrete Later this cap can be cut off and the 4" Sch. 40 PVC riser can be inserted, screwed and caulked into place
Risers are often placed in corners for convenience of later pipe routing. The plastic riser "tee" can be cut to allow for such situations.

RADON GAS. A naturally occurring, chemically inert, radioactive gas ~~that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.~~

Reason: *There is a significant amount of commentary and unnecessary language in this definition that is proposed for deletion.*

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene ~~or other equivalent material~~ used to retard the flow of soil gases into a ~~building~~ dwelling.

Reason: *There are two editorial revisions in this definition. The first deletes the reference to equivalencies which is frequently found in the section. Equivalencies are always permitted by R104.11. The second revision replaces the term "building" with "dwelling" here and throughout the section. This is to help make clear that the rules apply only to the dwelling and not an accessory building such as a garage.*

SUBMEMBRANE DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower submembrane air pressure relative to basement or crawl space air pressure by use of a vent pipe drawing air from beneath the soil-gas-retarder membrane.

Reason: *The term "basement or" is added to avoid conflicts where an underfloor space that meets the definition of a basement does not have a concrete or other floor system but only a soil floor.*

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Active).** A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.~~

Reason: *It is necessary that code language be easily understood by the public and code enforcement. Including language in the code that references non-required systems conflicts with that goal and can mislead the use and interpretation of the rule simply because the extra language exists. The feeling is that it must somehow apply because it is there. Users of the code may confuse the definition for active systems with passive systems and misapply the rule. The IRC language only requires a* ***passive*** *system. While it is necessary to define a passive system, it is not necessary to define an active system. It is therefore reasonable to delete this language as it serves no purpose.*

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe ~~routed through the *conditioned space* of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab~~ drawing air from beneath concrete floor slabs or other floor assemblies that are in contact with the ground.

> ***Reason:*** *It is not necessary to repeat language in the definition that is found elsewhere. Furthermore, a definition is proposed for the term "vent pipe" that contains the deleted language. The added language is for clarification and consistency with the definition of submembrane depressurization system.*

VENT PIPE. A minimum 3-inch diameter (76 mm) ABS or PVC gastight pipe extending from the gas permeable layer through the roof.

> ***Reason:*** *Again this definition is proposed to avoid the need to frequently repeat what a vent pipe is.*

SECTION AF103
~~REQUIREMENTS~~
PASSIVE RADON RESISTANT SYSTEM REQUIREMENTS

AF103.1 General. ~~The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary (see Figure AF102). These techniques are required in areas where designated by the *jurisdiction*.~~ The following components of a passive submembrane or subslab depressurization system shall be installed during construction.

> ***Reason:*** *The sentence deleted has been moved to the Scope as that is a more appropriate location.*

~~**AF103.2 Subfloor preparation.** A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a subslab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:~~

~~1. A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.~~
~~2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.~~
~~3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.~~

~~**AF103.3 Soil-gas-retarder.** A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly, and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.~~

> ***Reason:*** *The two previous sections have been relocated to the subslab and submembrane sections below so that they are located more appropriately. Also, a new definition for "gas-permeable layer" has been added to the definitions that incorporates much of the language in AF103.3.*

~~**AF103.4**~~ **AF103.2 Entry routes.** Potential radon entry routes shall be closed in accordance with Sections ~~AF103.4.1~~ AF103.2.1 through ~~AF103.4.10~~ AF103.2.7.

~~**AF103.4.1**~~ **AF103.2.1 Floor openings.** Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs~~,~~ or other floor assemblies~~,~~ shall be filled with a polyurethane caulk~~,~~ or expanding foam ~~or equivalent sealant~~ applied in accordance with the manufacturer's ~~recommendations~~ installation instructions.

> ***Reason:*** *These are largely editorial revisions but also provide for the use of expanding foam in larger spaces where caulking is not appropriate.*

~~**AF103.4.2 Concrete joints.** All control joints, isolation joints, construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.~~

> ***Reason:*** *This section requires that various joints in the floor slab be "sealed". The EPA booklet "Build Radon Out" gives some perspective on the need to "seal" these joints. The text found on page 51 follows:*

Seal control joints

Control joints in the concrete slab, whether they are saw cut or made with grooving tools, should be cleaned and filled with caulk. Even if they are not cracked initially, they will likely develop cracks in the future and caulking them before the floor finishes are in place makes sense. A gun-grade polyurethane or a flowable polyurethane can be used. This seal does not interfere with the expansion of the control joint, but does block radon entry.

The presumption advanced by the EPA booklet is that these joints, even if not initially cracked, will eventually crack and "caulking them before the floor finishes are in place makes sense".

However, the EPA booklet also states that one purpose for installing the soil gas membrane (plastic sheeting), is that it can bridge cracks that develop in the floor. This is stated on page 42 of the booklet.

Laying plastic sheeting between the gas permeable layer and the concrete slab or floor assembly serves several important purposes. The sheeting can prevent concrete from flowing down and clogging the gas permeable layer. It can also bridge any cracks that may develop in the slab or floor assembly, thereby reducing soil gas entry. Finally, the plastic sheeting can act as a vapor barrier to reduce moisture and other soil gas entry into the home.

If the plastic serves to bridge cracks, installing a sealant in the joints at the time of construction is redundant and unnecessary. The plastic will always be there. My argument is that the radon doesn't know what kind of crack it is trying to penetrate so that it cannot be more aggressive with a construction joint than it can with a crack due to shrinkage or expansion.

Also, I have received complaints from new homeowners that the sealant used in the joints in basement floors is slow to cure and that it gets on shoes and is tracked all over the new home. Clearly this is not an acceptable situation.

Also, flooring contractors complain about the caulking joint causing visible ridges in some flooring products and they almost always scrape the floors before installation removing most, if not all, of the caulking.

If the home has a crawl space, the plastic sheeting only need be overlapped by twelve inches. It is not required to be sealed. It is therefore unreasonable to seal a joint in a concrete floor over a plastic sheet when laps in the sheet do not need any special treatment when there is no floor. There just is no reasonable explanation that can be given.

Therefore, it is necessary that this section of the rule be deleted. This proposal is reasonable because sealing the joints is redundant given the language in the EPA booklet and laps in plastic sheeting need not be sealed when there is no floor.

~~**AF103.4.3 Condensate drains.** Condensate drains shall be trapped or routed through nonperforated pipe to daylight.~~
Reason: *Why can't condensate drains discharge to a floor drain or a sump? Why must they be trapped? This is already regulated by M1411.3.*

~~**AF103.4.4**~~ **AF103.2.2 Sumps.** Sumps ~~pits~~ open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or ~~otherwise~~ sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

~~**AF103.4.5**~~ **AF103.2.3 Foundation walls.** Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above ~~finished ground surface~~ grade ~~to prevent the passage of air from the interior of the wall into the living space~~. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be ~~sealed~~ solid masonry, one course of masonry grouted solid, or a solid concrete beam. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of ~~masonry block or wood~~ foundation walls below ~~the ground surface~~ grade shall be filled with polyurethane caulk ~~or equivalent sealant~~. ~~Penetrations of concrete walls shall be filled.~~
Reason: *Revisions are editorial to eliminate repetition, commentary language, and for clarity.*

~~**AF103.4.6**~~ **AF103.2.4 Dampproofing.** The exterior surfaces of ~~portions of concrete and masonry block~~ foundation walls below ~~the ground surface~~ grade shall be dampproofed in accordance with Section R406.
Reason: *Editorial revisions.*

~~**AF103.4.7**~~ **AF103.2.5** ~~**Air-handling units**~~ **Air-conditioning systems.** ~~Air-handling units~~ Entry points, joints, or other openings into air conditioning systems in enclosed crawl spaces shall be sealed ~~to prevent air from being drawn into the unit~~.
Exception: ~~Units~~ Systems with gasketed seams or ~~units~~ that are otherwise sealed by the manufacturer ~~to prevent leakage~~.
Reason: *The term "air-handling units" is not defined. "Air-conditioning systems" is defined in the IRC as: A system that consists of heat exchangers, blowers, filters, supply, exhaust and return-air systems, and shall include any apparatus installed in connection therewith." It is best to use a defined term to avoid confusion.*

~~**AF103.4.8**~~ **AF103.2.6 Ducts.** Ductwork passing through or beneath a slab within a dwelling shall be of seamless material unless the ~~air-handling~~ air-conditioning system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed ~~to prevent air leakage~~.

Ductwork located in enclosed crawl spaces shall have all seams and joints sealed by closure systems in accordance with Section M1601.4.1.
Reason: *Editorial revisions. Additionally, when the code includes language such as "to prevent air leakage", some code officials will interpret that to create a standard and that some testing is undertaken to illustrate that the standard is met. Some code officials will require a pressure test of the space to demonstrate that there is no air leakage. The presumption here is that such a standard was not intended.*

~~**AF103.4.9 Crawl space floors.** Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.~~
Reason: *These openings are already required to be sealed for purposes of fireblocking in section R302.11.*

~~**AF103.4.10**~~ **AF103.2.7 Crawl space access.** Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or ~~otherwise filled to prevent air leakage~~ sealed.
Reason: *Elimination of commentary language. Additionally, when the code includes language such as "to prevent air leakage", some code officials will interpret that to create a standard and that some testing is undertaken to illustrate that the standard is met. Some code officials will require a pressure test of the space to demonstrate that there is no air leakage. The presumption here is that such a standard was not intended.*

~~**AF103.5 Passive submembrane depressurization system**~~ **AF103.3 Basements or enclosed crawl spaces having soil floors.** In ~~buildings~~ dwellings with basements or enclosed crawl spaces ~~foundations~~ with soil floors, the following components of a passive submembrane depressurization system shall be installed during construction.
Exception: ~~Buildings in which an *approved* mechanical crawl space ventilation system or other equivalent system is installed.~~ Basements or enclosed crawl spaces that are provided with a continuously operated mechanical exhaust system in accordance with R408.3.
Reason: *Editorial revisions. Revisions also recognize any underfloor space with a soil floor regardless of what the space is called. Also, the exception references an "approved mechanical crawl space ventilation system or other equivalent system." It is not clear what the criteria might be for approving such a system or an equivalent system to that approved. So what is proposed here is the continuous mechanical exhaust system identified in R408.3.*

~~**AF103.5.1 Ventilation.** Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section R408.1.~~

Reason: *Crawl spaces are already required to be ventilated by R408.1. It isn't necessary to repeat that language here.*

~~AF103.5.2~~ AF103.3.1 Soil-gas-retarder. The soil in basements and enclosed crawl spaces shall be covered with a ~~continuous layer of minimum 6- mil (0.15 mm) polyethylene~~ soil-gas-retarder. The ~~ground cover~~ soil-gas-retarder shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the basement or crawl space ~~area~~. The soil-gas-retarder shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

Reason: *Editorial revisions. The last two sentences are taken from AF103.3 as the rules are applicable at this location.*

~~AF103.5.3 Vent pipe~~ AF103.3.2 "T" fitting and vent pipe. ~~A plumbing tee or other *approved* connection~~ A 3- or 4-inch "T" fitting shall be inserted ~~horizontally~~ beneath the ~~sheeting~~ soil gas retarder ~~and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting~~ and be connected to a vent pipe. The vent pipe shall ~~be extended up through the building floors,~~ extend through the conditioned space of the dwelling and terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point~~, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings~~.

Reason: *Largely editorial but also recognizing that definitions address the deleted language.*

~~AF103.6~~ AF103.4 ~~Passive subslab depressurization system~~ Basements or enclosed crawl spaces having concrete floors or other floor systems and slab on grade dwellings. ~~In *basement* or slab-on-grade buildings, the~~ The following components of a passive subslab depressurization system shall be installed during construction in slab on grade dwellings or in dwellings with basements or crawl spaces having concrete or other floor systems.

Reason: *Editorial revisions. Revisions also recognize any underfloor space with a concrete or other floor system regardless of what the space is called. It is not uncommon for crawl spaces to have concrete floors.*

AF103.4.1 Sub-slab preparation. A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the dwelling.

Reason: *This is text that has been relocated from AF103.2.*

AF103.4.2 Soil-gas-retarder. A soil gas retarder shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly. The soil-gas-retarder shall cover the entire floor area with separate sections lapped at least 12 inches (305 mm). The soil-gas-retarder shall fit closely around any pipe, wire, or other penetrations of the material. All punctures or tears in the material shall be sealed or covered.

Reason: *This text has been relocated from AF103.3.*

~~AF103.6.1~~ AF103.4.3 ~~Vent pipe~~ "T" fitting and vent pipe. ~~A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gas-tight pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system. The pipe shall be extended up through the building floors, and terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.~~ Before a slab is cast or other floor system is installed, a "T" fitting shall be inserted below the slab or other floor system and the soil-gas-retarder. The "T" fitting shall be connected to a vent pipe. The vent pipe shall extend through the conditioned space of the dwelling and terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point.

Reason: *Largely editorial but also recognizing that definitions address the deleted language. A portion of the new text came from AF103.3.*

AF103.5 Drain tile and sump used for depressurization. As an alternative to inserting a vent pipe into a "T" fitting, a vent pipe may be inserted directly into an interior perimeter drain tile loop or through a sump cover where the drain tile and/or sump is exposed to the gas permeable layer.

Reason: *This is new text that recognizes that a sump or drain tile can be used in a passive radon system.*

~~AF103.6.2~~ AF103.5 Multiple vent pipes. In ~~buildings~~ dwellings where interior footings or other barriers separate the ~~subslab aggregate or other~~ gas-permeable ~~material~~ layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

Reason: *Editorial revisions.*

AF103.5 Combination foundations. Where basement or crawl space floors are on different levels, each level shall have a separate vent pipe. Multiple vent pipes may be connected to a single vent pipe that terminates above the roof.

Reason: *This section has been relocated from later in the section to group like requirements. It has also been editorially revised for clarity.*

~~AF103.7~~ AF103.8 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the ~~slab or~~ soil-gas-retarder.

~~**AF103.8 Vent pipe accessibility.** Radon vent pipes shall be accessible for future fan installation through an *attic* or other area outside the *habitable space*.~~

> ~~**Exception:** The radon vent pipe need not be accessible in an *attic* space where an *approved* roof-top electrical supply is provided for future use.~~

Reason: *This section has been moved to the end of the section to group like requirements.*

~~**AF103.9**~~ **<u>AF103.9</u> Vent pipe identification.** All exposed and visible interior ~~radon~~ vent pipes shall be identified with at least one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

~~**AF103.10 Combination foundations.** Combination *basement*/ crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.~~

Reason: *This section has been moved up to group like requirements.*

~~**AF103.11 Building depressurization.** Joints in air ducts and plenums in un*conditioned spaces* shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.~~

> ***Reason:*** *It seems unnecessary to repeat requirements that are found elsewhere in the code.*

~~**AF103.12**~~ **<u>AF103.10</u> Power source <u>and access for future radon fan</u>.** To provide for future installation of ~~an active submembrane or subslab depressurization system~~ <u>a radon fan</u>, an electrical circuit terminated in an *approved* box shall be installed during construction in the ~~*attic* or other~~ anticipated location of ~~vent pipe~~ <u>the radon</u> fan~~s~~. ~~An electrical supply shall also be accessible in anticipated locations of system failure alarms.~~ <u>An accessible clear space 24 inches in diameter by 3 feet in height adjacent to the vent pipe shall be provided at the anticipated location of a future radon fan.</u>

> ***Reason:*** *This text applies to providing a space and power source for the future installation of a radon fan. The term "attic" has been deleted as it unnecessarily confuses where the placement of the electrical termination should be. The term "other anticipated location" implies that the fan could be placed anywhere, not just an attic. And since active systems aren't regulated, there will be no oversight to the final location of a fan anyway. The reference to "system failure alarms" is deleted as there are non-electrical ways of monitoring active systems and it would seem that the same box used to power the fan could power the alarm.*

To aid in understanding the impact of these changes, what follows is the revised text minus the cross-outs and underlines.

APPENDIX F
PASSIVE RADON GAS CONTROLS
(The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.)

SECTION AF101
SCOPE

AF101.1 General. This appendix contains requirements for new construction in *jurisdictions* where radon-resistant construction is required. These requirements are intended to provide a passive means of resisting radon gas entry and prepare the dwelling for post-construction radon mitigation, if necessary (see Figure AF102). Active construction techniques may be used in lieu of passive techniques when approved.

Inclusion of this appendix by *jurisdictions* shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1).

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.

ENCLOSED CRAWL SPACE. A crawl space that is enclosed with foundation walls that may include windows, doors, access openings, and required vents.

GAS-PERMEABLE LAYER. A gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate that is a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill) that is a minimum of 4 inches (102 mm) thick and that is overlain by a soil gas collection mat or soil gas matting installed in accordance with the manufacturer's installation instructions.

RADON GAS. A naturally occurring, chemically inert, radioactive gas.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene used to retard the flow of soil gases into a dwelling.

SUBMEMBRANE DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower submembrane air pressure relative to basement or crawl space air pressure by use of a vent pipe drawing air from beneath the soil-gas-retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent drawing air from beneath concrete floor slabs or other floor assemblies that are in contact with the ground.

VENT PIPE. A minimum 3-inch diameter (76 mm) ABS or PVC gastight pipe extending from the gas permeable layer through the roof.

SECTION AF103
PASSIVE RADON RESISTANT SYSTEM REQUIREMENTS

AF103.1 General. The following components of a passive submembrane or subslab depressurization system shall be installed during construction.

AF103.2 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.2.1 through AF103.2.8.

AF103.2.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or expanding foam applied in accordance with the manufacturer's installation instructions.

AF103.2.2 Sumps. Sumps open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

AF103.2.3 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above grade. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be solid masonry, one course of masonry grouted solid, or a solid concrete beam. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of foundation walls below grade shall be filled with polyurethane caulk.

AF103.2.4 Dampproofing. The exterior surfaces of foundation walls below grade shall be dampproofed in accordance with Section R406.

AF103.2.5 Air-conditioning systems. Entry points, joints, or other openings into air conditioning systems in enclosed crawl spaces shall be sealed.

Exception: Systems with gasketed seams or that are otherwise sealed by the manufacturer.

AF103.2.6 Ducts. Ductwork passing through or beneath a slab within a dwelling shall be of seamless material unless the air-conditioning system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed.

Ductwork located in enclosed crawl spaces shall have all seams and joints sealed by closure systems in accordance with Section M1601.4.1.

AF103.2.7 Crawl space access. Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or sealed.

AF103.3 Basements or enclosed crawl spaces having soil floors. In dwellings with basements or enclosed crawl spaces with soil floors, the following components of a passive submembrane depressurization system shall be installed during construction.

Exception: Basements or enclosed crawl spaces that are provided with a continuously operated mechanical exhaust system in accordance with R408.3.

AF103.3.1 Soil-gas-retarder. The soil in basements and enclosed crawl spaces shall be covered with a soil-gas-retarder. The soil-gas-retarder shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the basement or crawl space. The soil-gas-retarder shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

AF103.3.2 "T" fitting and vent pipe. A 3- or 4-inch "T" fitting shall be inserted beneath the soil gas retarder and be connected to a vent pipe. The vent pipe shall extend through the conditioned space of the dwelling and terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point.

AF103.4 Basements or enclosed crawl spaces having concrete floors or other floor systems and slab on grade dwellings. The following components of a passive subslab depressurization system shall be installed during construction in slab on grade dwellings or in dwellings with basements or crawl spaces having concrete or other floor systems.

AF103.4.1 Sub-slab preparation. A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the dwelling.

AF103.4.2 Soil-gas-retarder. A soil gas retarder shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly. The soil-gas-retarder shall cover the entire floor area with separate sections lapped at least 12 inches (305 mm). The soil-gas-retarder shall fit closely around any pipe, wire, or other penetrations of the material. All punctures or tears in the material shall be sealed or covered.

AF103.4.3 "T" fitting and vent pipe. Before a slab is cast or other floor system is installed, a "T" fitting shall be inserted below the slab or other floor system and the soil-gas-retarder. The "T" fitting shall be connected to a vent pipe. The vent pipe shall extend through the conditioned space of the dwelling and terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point.

AF103.5 Drain tile and sump used for depressurization. As an alternative to inserting a vent pipe into a "T" fitting, a vent pipe may be inserted directly into an interior perimeter drain tile loop or through a sump cover where the drain tile and/or sump is exposed to the gas permeable layer.

AF103.6 Multiple vent pipes. In dwellings where interior footings or other barriers separate the gas-permeable layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.7 Combination foundations. Where basement or crawl space floors are on different levels, each level shall have a separate vent pipe. Multiple vent pipes may be connected to a single vent pipe that terminates above the roof.

AF103.8 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the soil-gas-retarder.

AF103.9 Vent pipe identification. All exposed and visible interior vent pipes shall be identified with at least one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

AF103.10 Power source and access for future radon fan. To provide for future installation of a radon fan, an electrical circuit terminated in an *approved* box shall be installed during construction in the anticipated location of the radon fan. An accessible clear space 24 inches in diameter by 3 feet in height adjacent to the vent pipe shall be provided at the anticipated location of a future radon fan.

Cost Impact: None

RB462-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

APPENDIX F-RB-DAVIDSON

RB463 – 13

AG101.2, AG103.3, AG103.3 (New), AG103.4 (New)

Proponent: Gregory Wilson, representing Department of Homeland Security, Federal Emergency Management Agency (Gregory.wilson2@fema.dhs.gov) and Rebecca Quinn, RCQuinn Consulting, Inc., representing Federal Emergency Management Agency (rcquinn@earthlink.net).

Revise as follows:

~~**AG101.2**~~ **AG103.3 Pools in flood hazard areas.** Pools that are located in flood hazard areas established by Table R301.2(1), including above-ground pools, on-ground pools and in-ground pools that involve placement of fill, shall comply with this section ~~Sections AG101.2.1 or AG101.2.2~~.

AG103.3.1 Determination of impacts based on location. Pools shall comply with Section AG103.3.1.1 or AG103.1.2.

> **Exception:** Pools located in riverine flood hazard areas which are outside of designated floodways and pools located in flood hazard areas where the source of flooding is tides, storm surges or coastal storms.

~~**AG101.2.1**~~ **AG103.3.1.1 Pools located in designated floodways.** Where pools are located in designated floodways, documentation shall be submitted to the building official, which demonstrates that the construction of the pool will not increase the design flood elevation at any point within the jurisdiction.

~~**AG101.2.2**~~ **AG103.3.1.2 Pools located where floodways have not been designated.** Where pools are located where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed pool will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction.

~~**AG103.3**~~ **AG103.3.2 Pools in ~~flood~~ coastal high hazard areas.** In ~~flood~~ coastal high hazard areas ~~established by Table R301.2(1)~~, pools ~~in coastal high-hazard areas~~ shall be designed and constructed in conformance with ASCE 24.

AG103.3.3 Protection of equipment. Equipment shall be elevated to or above the design flood elevation or be anchored to prevent flotation and protected to prevent water from entering or accumulating within the components during conditions of flooding.

AG103.3.4 GFCI protection. Electrical equipment installed below the design flood elevation shall be supplied by branch circuits that have ground-fault circuit interrupter protection.

Reason: This proposal consolidates existing requirements in one section (AG103.3), which is how the flood requirements are formatted in the International Swimming Pool and Spa Code (see Section 304 Flood Hazard Areas). When consolidated, the exception to AG103.3.1 is less confusing. AG103.3.1 is intended to capture pools in floodways (which must satisfy AG103.3.1.1) and pools in flood hazard areas with base flood elevations but without floodways (which must satisfy AG103.3.1.2). All other pools are covered by the exception and do not need to satisfy any additional determination based on location.

The addition of requirements for equipment and electrical equipment protection, which apply to all pools, is consistent with the requirements in the 2012 International Swimming Pool and Spa Code, Section 304.4 and 304.5, respectively.

Cost Impact: This proposal should not increase costs because pools and pool equipment, where installed in flood hazard areas, have long been subject to these requirements under local floodplain management regulations adopted and enforced by communities that participate in the national flood insurance program.

RB463-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

AG101.2-RB-QUINN-WILSON.DOC

RB464 – 13

NUMBER NOT USED

RB465 – 13

Appendix G, R324 (New), R324.1 (New)

Proponent: Kris Bridges, CBO, Chair, ICC Swimming Pool Code Drafting Committee (SPCDC)

Delete Appendix G in its entirety:

~~**APPENDIX G**~~
~~**SWIMMING POOLS, SPAS AND HOT TUBS**~~

Add new Section and new text as follows:

SECTION R324
SWIMMING POOLS, SPAS AND HOT TUBS

R324.1 General. The design and construction of aquatic vessels shall comply with the *International Swimming Pool and Spa Code*.

Reason: The drafting of the *International Swimming Pool and Spa Code* (ISPSC) started in October/2010 by the Swimming Pool Code Drafting Committee (SPCDC) which was established by the ICC Board of Directors, with the Association of Pool & Spa Professionals (APSP) as a Cooperating Sponsor. The SPCDC was a broad based committee representing a balance of interests composed of 15 individuals from public, private and nonprofit sectors with expertise in disciplines critical to the topics in the *International Swimming Pool and Spa Code*. The SPCDC was supported by four Work Groups composed of numerous interested parties and stakeholders.
The intent was to develop a comprehensive set of regulations for swimming pools and spas consistent and coordinated with the I-Codes. Technical content was developed from provisions from the International Codes and the applicable APSP standards. The APSP standards considered were:

- ANSI-1 2003 Public Swimming Pools
- ANSI-2 1999 Public Spas
- ANSI-3 1999 Permanent Residential Spas
- ANSI-4 2007 Aboveground/On-ground Residential Swimming Pools
- ANSI-5 2003 Residential In-ground Swimming Pools
- ANSI-6 1999 Portal Spas
- ANSI-7 2006 Suction Entrapment Avoidance
- ANSI-8 2005 Model Barrier Code
- ANSI-9 2005 Aquatic Recreational Facilities
- ANSI-11 2009 Standard for water quality in public swimming pools and spas

The SPCDC and its Work Groups comprehensively reviewed the requirements in the existing 2009 International Codes and the standards noted above in an effort to draft comprehensive language for pool and spa safety while at the same time making sure the language resulted in adoptable and enforceable I-Code language.
The SPCDC held three face-to-face drafting meetings and there were weekly work group conference calls. The drafting effort of the SBCDC culminated in Public Version 1.0 (PV 1.0) which was completed in February/2011.
Public Version 1.0 was then subjected to a full cycle of ICC Code Development in 2011 as follows:

- PV 1.0 posted for code change submittals on February 1, 2011
- 100 code changes were submitted
- The ISPSC code committee comprised of both SBCDC members and new members acted on the code changes at the 2011 Code Development Hearings held May 16, 2011 in Dallas.
- Public comments were submitted on 22 of the code changes and were acted on by the ICC membership at the 2011 Final Action Hearings held October 31, 2011 in Phoenix
- The 2012 International Swimming Pool and Spa Code is published.

The ISPSC uses the term “aquatic vessels” to cover all types of vessels including pools, water parks, spas and hot tubs. This proposal is limited to the use and application of vessels under the IRC, including pools, spas and hot tubs. The ISPSC provisions comprehensively address all aspects of such vessels including;

- Administration and Definitions
- Construction features for pools including size and depth, wall and floor construction, and calculation of bather occupant load
- Safety features such as barriers to pool entry, depth markers and throwing ropes
- Mechanical, plumbing and electrical provisions

- Equipment such as suction entrapment avoidance, circulation, filters, pumps and motors, skimmers, heaters, return and suction fittings
- Appurtenances such as ladders and diving equipment

The ISPSC covers both residential and public aquatic vessels. A similar proposal was submitted to Section 3109 of the IBC in Group A 2012 (G193 Part I). The committee action was AM. The final action was D.

Cost Impact: This code change proposal will not increase the cost of construction.

RB465-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

APPENDIX G-RB-BRIDGES.doc

RB466 – 13
AH106.4.1, AH106.4.3, Table AH106.4(1), Table AH106.4(2), Figure AH106 (New)

Proponent: Gary J. Ehrlich, P.E., National Association of Home Builders (NAHB) (gehrlich@nahb.org); Daniel J. Walker, P.E., Thomas Associates, Inc. representing National Sunroom Association.

Revise as follows:

AH106.4.1 Wind Load. Structural members supporting screen enclosures shall be designed to support the minimum wind loads given in Tables AH106.4(1) and AH106.4(2) for the ultimate design wind speed, V_{ult}, determined from Figure AH106. Where any value is less than 10 pounds per square foot (psf) (0.479 kN/m^2) use 10 pounds per square ~~feet~~ foot (0.479 kN/m^2).

~~**AH106.4.3 Importance factor.** The wind factor for screen enclosures shall be 0.77 in accordance with Section 6.5.5 of ASCE 7.~~

~~TABLE AH106.4(1)~~
~~DESIGN WIND PRESSURES FOR ALUMINUM SCREEN ENCLOSURE FRAMING WITH AN IMPORTANCE FACTOR OF 0.77~~[~~a, b, c~~]

~~LOAD CASE~~	~~WALL~~	~~Basic Wind Speed (mph)~~											
		~~100~~		~~110~~		~~120~~		~~130~~		~~140~~		~~150~~	
		~~Exposure Category Design Pressure (psf)~~											
		~~C~~	~~B~~	~~C~~	~~B~~	~~C~~	~~B~~	~~C~~	~~B~~	~~C~~	~~B~~	~~C~~	~~B~~
~~A~~[~~d~~]	~~Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 0-1~~	~~12~~	~~8~~	~~14~~	~~10~~	~~17~~	~~12~~	~~19~~	~~14~~	~~23~~	~~16~~	~~26~~	~~18~~
~~A~~[~~d~~]	~~Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 2~~	~~13~~	~~9~~	~~16~~	~~11~~	~~19~~	~~14~~	~~22~~	~~16~~	~~26~~	~~18~~	~~30~~	~~21~~
~~B~~[e]	~~Windward: Nongable roof~~	~~16~~	~~12~~	~~20~~	~~14~~	~~24~~	~~17~~	~~28~~	~~20~~	~~32~~	~~23~~	~~37~~	~~26~~
~~B~~[e]	~~Windward: Gable roof~~	~~22~~	~~16~~	~~27~~	~~19~~	~~32~~	~~23~~	~~38~~	~~27~~	~~44~~	~~31~~	~~50~~	~~36~~
-	~~ROOF~~	-											
~~All~~[f]	~~Roof-screen~~	~~4~~	~~3~~	~~5~~	~~4~~	~~6~~	~~4~~	~~7~~	~~5~~	~~8~~	~~6~~	~~9~~	~~7~~
~~All~~[f]	~~Roof-solid~~	~~12~~	~~9~~	~~15~~	~~11~~	~~18~~	~~13~~	~~21~~	~~15~~	~~24~~	~~17~~	~~28~~	~~20~~

~~For SI: 1 mile per hour = 0.44 m/s, 1 pound per square foot = 0.0479 kPa, 1 foot = 304.8 mm.~~

~~a. Values have been reduced for 0.77 importance factor in accordance with Section AH106.4.3.~~

~~b. Minimum design pressure shall be 10 psf in accordance with Section AH106.4.1.~~

~~c. Loads are applicable to screen enclosures with a mean roof height of 30 feet or less. For screen enclosures of different heights, the pressures given shall be adjusted by multiplying the table pressure by the adjustment factor given in Table AH106.4(2).~~

~~d. For Load Case A flow thru condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall also be analyzed for wind coming from the opposite direction. For the nonflow thru condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure.~~

~~e. For Load Case B, the table pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, which must be transmitted to the ground. Use Load Case A for members directly supporting the screen surface perpendicular to the wind. Load Case B loads shall be applied only to structural members which carry wind loads from more than one surface.~~

~~f. The roof structure shall be analyzed for the pressure given occurring both upward and downward.~~

~~TABLE AH106.4(2)~~
~~HEIGHT ADJUSTMENT FACTORS~~

~~MEAN~~	~~EXPOSURE~~	
~~Roof Height (feet)~~	~~B~~	~~C~~
~~15~~	~~1~~	~~0.86~~
~~20~~	~~1~~	~~0.92~~
~~25~~	~~1~~	~~0.96~~
~~30~~	~~1~~	~~1.00~~
~~35~~	~~1.05~~	~~1.03~~
~~40~~	~~1.09~~	~~1.06~~
~~45~~	~~1.12~~	~~1.09~~
~~50~~	~~1.16~~	~~1.11~~
~~55~~	~~1.19~~	~~1.14~~
~~60~~	~~1.22~~	~~1.16~~

~~For SI: 1 foot = 304.8 mm.~~

TABLE AH106.4(1)
DESIGN WIND PRESSURES FOR SCREEN ENCLOSURE FRAMING[a,b,e,f,g,h]

LOAD CASE	WALL	Ultimate Design Wind Speed, V_{ult} (mph)									
		100	105	110	120	130	140	150	160	170	180
		Exposure Category B Design Pressure (psf)									
A[c]	Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 0-1	6	7	8	9	11	13	14	16	18	21
A[c]	Windward and leeward walls (flow thru) and windward wall (nonflow thru) *L/W* = 2	7	8	9	11	12	14	16	19	21	24
B[d]	Windward: Nongable roof	9	10	11	13	15	18	21	23	26	30
B[d]	Windward: Gable roof	11	13	14	16	19	22	26	29	33	37
	ROOF										
All[e]	Roof-screen	2	3	3	3	4	4	5	6	7	7
All[e]	Roof-solid	7	8	8	10	12	13	15	18	20	22

For SI: 1 mile per hour = 0.44 m/s, 1 pound per square foot = 0.0479 kPa, 1 foot = 304.8 mm.

a. Minimum design pressure shall be 10 psf in accordance with Section AH106.4.1

b. Loads are applicable to screen enclosures with a mean roof height of 30 feet or less in Exposure B. For screen enclosures of different heights or exposure, the pressures given shall be adjusted by multiplying the table pressure by the adjustment factor given in Table AH106.4(2).

c. For Load Case A flow thru condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall also be analyzed for wind coming from the opposite direction. For the nonflow thru condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure.

d. For Load Case B, the table pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, which must be transmitted to the ground. Use Load Case A for members directly supporting the screen surface perpendicular to the wind. Load Case B loads shall be applied only to structural members which carry wind loads from more than one surface.

e. The roof structure shall be analyzed for the pressure given occurring both upward and downward.

f. Table pressures are MWFRS loads. The design of solid roof panels and their attachments shall be based on component and cladding loads for enclosed or partially enclosed structures as appropriate.

g. Table pressures apply to 20 x 20 x 0.013” mesh screen. For 18 x 14 x 0.013” mesh screen, pressures on screen surfaces shall be permitted to be multiplied by 0.88. For screen densities greater than 20 x 20 x 0.013”, pressures for enclosed buildings shall be used.

h. Linear interpolated shall be permitted.

TABLE AH106.4(2)
ADJUSTMENT FACTOR
FOR BUILDING HEIGHT AND EXPOSURE

Mean Roof Height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

For SI: 1 foot = 304.8mm

Figure AH106
Ultimate Design Wind Speeds for Patio Covers and Screen Enclosures

Reason: The purpose of this code change is to bring the wind provisions of the IRC in line with the 2012 IBC and ASCE 7-10. As a result of the schedule changes implemented during the 2009-2010 ICC code development cycle, there was not sufficient time to revise the IRC to fully implement the new ultimate wind speed basis of ASCE 7-10 and the 2012 IBC, due to the extent of prescriptive IRC provisions and tables which are directly related to basic wind speed.. New maps based on the ASCE 7-10 ultimate wind speed data but converted back down to nominal (ASD) basis were provided in the IRC. This has led to a fair amount of confusion among those stakeholders who work with both codes.

A working group of stakeholders including NAHB, the major material associations, ASCE, and the Insurance Institute for Business and Home Safety developed a series of IRC proposals to implement the new ultimate wind speed basis. This proposal updates Table AH106.4(1) and AH106.4(2) for patio covers. Since ASCE 7-10 implemented a new 300-year mean return interval map for Risk Category I structures (which includes patio covers) to replace the use of the 0.87 (non-hurricane) and 0.77 (hurricane) importance factors, Section AH106.4.3 is deleted and a new Figure AH106 copies the Risk Category I wind map from IBC Figure 1609C.

The coefficients used to produce the updated table are the same as that from the previous tables in IRC Appendix "H", which were based on wind tunnel testing commissioned by the Aluminum Association of Florida and conducted at the Clemson and Virginia Tech wind tunnels by Dr. Timothy Reinhold, P.E., Ph.D and Mr. Charley Everly, P.E. The original test report can be downloaded for review from the following link:
http://aaof.org/documents/WindLoadsOnScreenEnclosures%28Reinhold%29.pdf. Additional clarification has also been added to the table footnotes based on additional details found in the referenced report.

Cost Impact: The code change proposal will not increase the cost of construction.

RB466-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

AH106.4.1-RB-EHRLICH-WALKER

RB467 – 13
Appendix J

Proponent: Carl Baldassarra, P.E., FSFPE, Chair, ICC Code Technology Committee (cbaldassarra@rjagroup.com)

Revise as follows:

AJ102.4 Replacement windows and replacement safety glazing. Regardless of the category of work, when an existing window, including the sash and glazed portion, or safety glazing is replaced, the replacement window or safety glazing shall comply with the following requirements as applicable: ~~of Chapter 11.~~

AJ102.4.1 Energy efficiency. Replacement windows shall comply with the requirements of Chapter 11.

AJ102.4.2 Safety glazing. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.

AJ102.4.3 Emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings*, replacement windows shall be exempt from the maximum sill height requirements of Sections R310.1 and the requirements of Sections R310.1.1, R310.1.2, R310.1.3 and R310.2 provided the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement window is not part of a change of occupancy.
3. Window opening control devices complying with ASTM F 2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings.*

AJ102.4.4 Window control devices. Where window fall prevention devices complying with ASTM F2090 are not provided, window opening control devices complying with ASTM F 2090 shall be installed where an existing window is replaced and where all the following apply to the replacement window:

1. The window is operable;
2. The window replacement includes replacement of the sash and the frame;
3. The top of the sill of the window opening is at a height less than 24 inches (610 mm) above the finished floor;
4. The window will permit openings that will allow passage of a 4-inch diameter (102 mm) sphere when the window is in its largest opened position; and,
5. The vertical distance from the top of the sill of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit.

~~**AJ301.3 Safety glazing.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.1.~~

Reason: This proposed change is a result of the CTC's investigation of the area of study entitled "Child Window Safety". The scope of the activity is noted as:

To evaluate the necessity of developing code proposals for the inclusion of requirements dealing with the conditions, circumstances and devices for window safety which could reduce the number of falls by children to surfaces below.

The purpose of this proposal is to coordinate the existing building provisions of the IRC with the changes approved to the IBC/IEBC in the 2012 Group A cycle. Code changes G225-12 and G227-12 were approved as modified by public comment to revise Section 3407 of the IBC (IEBC Section 406 – see below). In addition, Code change G201-12 last cycle removed the existing building provisions from Chapter 34 of the IBC in favor of a reference to the IEBC. This action was subsequently affirmed by the ICC Board as this was a code change related to I-Code scoping.

The format/terminology of Appendix J in the IRC is a bit different than the approach in the IEBC. However, Section AJ102 stipulates that the provisions of the section are applicable to all categories of work. It is for this reason that the provisions have been comprehensively located in AJ102 versus the sections that deal with the different categories of work (ie repairs in AJ301; renovations in AJ401; and alterations in AJ501.

For reference, the approved IEBC text is as follows:

IEBC SECTION 406
GLASS REPLACEMENT AND REPLACEMENT WINDOWS

406.1 Replacement glass. *The installation or replacement of glass shall be as required for new installations.*

406.2 Replacement Window Opening Control Devices. *In Group R-2 or R-3 buildings containing dwelling units, window opening control devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all the following apply to the replacement window:*

1. The window is operable;
2. The window replacement includes replacement of the sash and the frame;
3. The top of the sill of the window opening is at a height less than 36 inches (915 mm) above the finished floor;
4. The window will permit openings that will allow passage of a 4-inch diameter (102 mm) sphere when the window is in its largest opened position; and
5. The vertical distance from the top of the sill of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1029.2.

Exceptions:

1. Operable windows where the top of the sill of the window opening is located more than 75 feet (22.86 m) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F 2006.
2. Operable windows with openings that are provided with window fall prevention devices that comply with ASTM F2090.

406.3 Replacement Window Emergency Escape and Rescue Openings. *Where windows are required to provide emergency escape and rescue openings in Group R-2 and R-3 occupancies, replacement windows shall be exempt from the requirements of Sections 1029.2, 1029.3 and 1029.5 provided the replacement window meets the following conditions:*

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement of the window is not part of a change of occupancy.

This proposal is submitted by the ICC Code Technology Committee. The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as “areas of study”. Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: http://www.iccsafe.org/cs/CTC/Pages/default.aspx. Since its inception in April/2005, the CTC has held twenty-five meetings - all open to the public. In 2012, three of the 25 face-to face meetings were held. In addition to the CTC meetings, the CTC established Study Groups (SG) of interested parties for each of the areas of study. These SG’s are responsible for reviewing the available information and making recommendations to the CTC. All totaled, the SG’s held over 70 conference calls in 2012.

Cost Impact: This code change proposal will not increase the cost of construction.

RB467- 13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	D

AJ102.4-RB-BALDASSARRA-CTC

RB468 – 13

AJ102.4, AJ102.4.1 (New), AJ102.4.2 (New), AJ102.4.3 (New), AJ102.4.4 (New), and AJ301.3

Proponent: Jeff Inks, Window and Door Manufacturers Association, representing the Window & Door Manufacturers Association.

Revise as follows:

AJ102.4 Replacement windows and replacement safety glazing. Regardless of the category of work, when an existing window, including the sash and glazed portion, or safety glazing is replaced, the replacement window or safety glazing shall comply with the requirements of Sections AJ102.4.1 through AJ102.4.4 as applicable: ~~of Chapter 11.~~

AJ102.4.1 Energy efficiency. Replacement windows shall comply with the requirements of Chapter 11.

AJ102.4.2 Safety glazing. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.1.

AJ102.4.3 Emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings*, replacement windows shall be exempt from the maximum sill height requirements of Sections R310.1 and the requirements of Sections R310.1.1, R310.1.2, R310.1.3 and R310.2 provided the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement window is not part of a change of occupancy.

Window opening control devices complying with ASTM F 2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings.*

AJ102.4.4 Window opening control devices. Window opening control devices complying with ASTM F 2090 shall be installed where an existing window is replaced and where all the following apply to the replacement window:

1. The window is operable;
2. The window replacement includes replacement of the sash and the frame;
3. The top of the sill of the window opening is at a height less than 24 inches (610 mm) above the finished floor;
4. The window will permit openings that will allow passage of a 4-inch diameter (102 mm) sphere when the window is in its largest opened position; and,
5. The vertical distance from the top of the sill of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit.

~~**AJ301.3 Safety glazing.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.1.~~

Reason: The intent of this proposal is to update Appendix J with respect window replacements to ensure window replacements also meet the requirements for new construction for window opening control devices and emergency escape and rescue openings for new construction when practical and avoid discouraging or preventing the replacement of windows when it is not -- provided there is no reduction in existing safety. In addition, this proposal moves all provisions for window and glazing replacements under existing

Section AJ102.4 as they are intended to apply to all replacements regardless of work classification and so improves the organization and use of the Appendix with respect to glazing and window replacements.

With respect to the proposed emergency escape and rescue opening provisions, they are based on Minnesota's residential code which actually (and effectively) incorporates them into the main body of the code in Chapter 3, under Section 310.1. The same provisions have also already been approved for Chap. 4 of the IEBC (during the Group A proceedings) and we, as well as the ICC CTC are also proposing the same provisions for Chap. 7 of the IEBC (in addition to this proposal for IRC Appendix J). Most importantly, it's important to note that the provisions do not allow for any decrease in safety and rather will help ensure improvements in safety can be made.

More specifically, the intent of this proposal is to ensure that the IRC does not discourage or prevent improvements in emergency escape and rescue openings, especially for fire safety, in older residential occupancies by requiring replacement windows to meet all of the provisions of Section 310 when doing so can only be accomplished by increasing the size of the rough opening or altering the interior wall.

Because many of these older buildings were constructed under codes that did not include the same emergency escape and rescue opening provisions that the IRC now requires for new construction, the only way to fully meet all of the requirements of Section 310 for new construction if required when windows are replaced, is to enlarge the rough opening and/or make significant alterations to the interior wall in order to accommodate any increase in window size or lowering of a sill.

At the very least, the significant cost and design challenges of altering the rough opening or interior wall can discourage or prevent window replacement and at worst can discourage or prevent the replacement of older windows that are harder to operate or inoperable all together because of their age or poor maintenance and, that are significantly less energy efficient. When that happens, improvements to safety as well as to energy efficiency are needlessly compromised.

Furthermore and on the whole, while some bedroom windows in older homes may not provide the full clear opening that is required for new construction or may have a sill height above 44 inches, they nonetheless still provide a viable emergency and escape rescue opening which is the primary intent of the code. Replacement of these windows with the same type of operating window or other type that can provide an equal or greater clear opening than the existing window -- even if they do not fully meet the clear opening or sill height requirements of Section 310 – is always an improvement in safety, especially when a replacement opening can provide a larger clear opening than the existing window. Such improvements in safety should not be discouraged or prevented by overly onerous requirements for replacement windows.

This proposal will help ensure that doesn't happen by providing limited exceptions to the requirements of Section 310 that can only be applied when certain conditions are met and that as already noted, will not result in a decrease in safety.

The requirements for new construction that emergency escape and rescue openings be provided as well as the operational requirements of Section 310.1.4 are maintained and still applicable to replacement windows.

With respect to the proposed provisions for window opening control devices on replacement windows, they are intended to ensure window fall protection is provided where required for new construction when windows, including sash and frame, are replaced. Like the EERO provisions, the WOCD provisions have already been approved by for Chap. 4 of the IEBC and are also be proposed for IEBC Chap. 7 by us and the ICC CTC.

Item #3 simply deletes the safety glazing provisions from Section AJ301.3 because they were moved to Section AJ102.4.2

Cost Impact: This code change proposal will not increase the cost of construction.

RB468-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

AJ102.4-RB-INKS

RB469 – 13
AJ102.6

Proponent: David Bonowitz, Chair, Existing Buildings Subcommittee, Code Advisory Committee, National Council of Structural Engineers Associations (dbonowitz@att.net)

Revise as follows:

AJ102.6 Equivalent alternatives. Work performed in accordance with the *International Existing Building Code* shall be deemed to comply with the provisions of this appendix. These provisions are not intended to prevent the use of any alternative material, alternative design or alternative method of construction not specifically prescribed herein, provided any alternative has been deemed to be equivalent and its use authorized by the *building official*.

Reason: This proposal recognizes the IEBC as a specific "deemed to comply" alternative to Appendix J. The proposed provision would parallel IRC section R301.1.3, which states, "Engineered design in accordance with the *International Building Code* is permitted for all buildings and structures, and parts thereof, included in the scope of this code." It is also consistent with IRC section R104.11, which states, "Compliance with the specific performance-based provisions of the International Codes in lieu of specific requirements of this code shall also be permitted as an alternate."

From its terminology and organization, it is clear that Appendix J and the current IEBC Work Area method have a common ancestor; they each evolved from the "Nationally Applicable Recommended Rehabilitation Provisions," written by NAHB and others for HUD and published in 1997. The IEBC is thus a natural and appropriate alternative to Appendix J.

Indeed, one could easily make a case that Appendix J (as well as some of the IRC's other provisions for existing buildings) could, or should, be replaced in its entirety by a reference to the IEBC. We have not proposed that step. For now, we are merely proposing that the IEBC be recognized as an appropriate alternative.

While its provisions differ slightly (owing to the fact that the IEBC has been maintained and improved in recent cycles while Appendix J has not), the IEBC does offer certain advantages to the design professional and code official. It has more complete and consistent provisions that address specific load cases and combinations, cite appropriate national standards, include Appendix A3 for prescriptive seismic retrofit, include appropriate quality control measures, etc. Using the IEBC would also avoid some of the obsolete and internally inconsistent provisions in Appendix J (such as the definitions of "dangerous" and "load-bearing element," the confusing reference to "extensive alterations," etc.).

Cost Impact: None

RB469-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

AJ102.6-RB-BONOWITZ

RB470 – 13
AJ102.7

Proponent: David Bonowitz, Chair, Existing Buildings Subcommittee, Code Advisory Committee, National Council of Structural Engineers Associations (dbonowitz@att.net)

Revise text as follows:

AJ102.7 Other alternatives. Where compliance with these provisions or with this code as required by these provisions is technically infeasible or would impose disproportionate costs because of ~~structural,~~ construction or dimensional difficulties, other alternatives may be accepted by the building official. These alternatives may include materials, design features and/or operational features.

Reason: This proposal removes the “structural” conditions from the list of conditions that might be found cost-prohibitive. The idea of allowing workarounds and reasonable variances for “technically infeasible” triggered improvements is fair; usually it applies only to accessibility improvements and sometimes to prescriptive requirements for new construction that are not met to the letter by an existing building. But we do not believe it is the intent of the IRC to allow the code official to waive basic structural safety requirements triggered by the IRC or Appendix J.

Further, Appendix J is already careful to trigger structural work only in rare cases of demonstrated deficiency and or in cases of major alterations. Triggered structural upgrades will be rare, and where they are triggered they will address actual hazards, not just procedural nonconformities. Therefore, it is inappropriate to allow structural safety provisions to be waived simply on cost grounds.

Cost Impact: None

RB470-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

AJ102.7-RB-BONOWITZ

RB471 – 13
Appendix R (New)

Proponent: Paula Baker-Laporte, FAIA, EcoNest Company, representing Natural Building Network (paula@econest.com)

Add new text as follows:

APPENDIX R
LIGHT STRAW-CLAY CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION AR101
GENERAL

AR101.1 Scope. This appendix shall govern the use of light straw-clay as a non-bearing building material and wall infill system.

SECTION AR102
DEFINITIONS

AR102.1. General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions.

CLAY. Inorganic soil with particle sizes of less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity.

CLAY SLIP. A suspension of clay soil in water.

CLAY SOIL. Inorganic soil containing 50% or more clay by volume.

INFILL. Light straw-clay that is placed between the structural members of a building.

LIGHT STRAW-CLAY. A mixture of straw and clay compacted to form insulation and plaster substrate between or around structural and non-structural members in a wall.

NON-BEARING. Not bearing the weight of the building other than the weight of the light straw-clay itself and its finish.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

VOID. Any space in a light straw-clay wall in which a 2-inch (51 mm) sphere can be inserted.

SECTION AR103
NON-BEARING LIGHT STRAW-CLAY CONSTRUCTION

AR103.1 General. Light straw-clay shall be limited to infill between or around structural and non-structural wall framing members.

AR103.2 Structure. The structure of buildings using light straw-clay shall be in accordance with the *International Residential Code* or shall be in accordance with an approved design by a *registered design professional*.

AR103.2.1 Number of stories. Use of light straw-clay infill shall be limited to buildings that are not more than one-story above grade plane.

Exception: Buildings using light straw-clay infill that are greater than one-story above grade plane shall be in accordance with an *approved* design by a *registered design professional*.

AR103.2.2 Bracing. Wind and seismic bracing shall be in accordance with Section R602.10 and shall use Method LIB. The required length of bracing shall comply with Section R602.10.3, with the additional requirements that Table 602.10.3(3) shall be applicable to all buildings in Seismic Design Category C, and that the minimum total length of bracing in Table R602.10.3(3) shall be increased by 90%. In lieu of these prescriptive requirements, wind and seismic bracing shall be in accordance with an *approved* design by *a registered design professional*. Walls with light straw-clay infill shall not be sheathed with solid sheathing.

AR103.2.3 Weight of light straw-clay. Light straw-clay shall be deemed to have a design dead load of 40 pounds per cubic foot (640 kg per cubic meter) unless otherwise demonstrated to the building official.

AR103. 2.4 Reinforcement of light straw-clay. Light straw-clay shall be reinforced as follows:

1. Vertical reinforcing shall be a minimum of nominal 2-inch by 6-inch (51 mm by 152 mm) wood members at a maximum of 32 inches (813 mm) on center where the vertical reinforcing is nonload-bearing and at 24"(610mm) on center where it is load-bearing. The vertical reinforcing shall not exceed an unrestrained height of 10 feet (3,048 mm) and shall be attached at top and bottom in accordance with Chapter 6 of the International Residential Code. In lieu of these requirements, vertical reinforcing shall be in accordance with an approved design by a registered design professional.
2. Horizontal reinforcing shall be installed in the center of the wall at not more than 24 inches (610 mm) on center and shall be secured to vertical members. Horizontal reinforcing shall be of any of the following: ¾ inch (19 mm) bamboo, ½ inch (13 mm) fiberglass rod, 1-inch (25 mm) wood dowel or nominal 1-inch by 2-inch (25 mm by 51 mm) wood.

AR103.3 Materials. The materials used in light straw-clay construction shall be in accordance with Sections AR103.3.1 through AR103.3.4.

AR103.3.1 Straw. Straw shall be wheat, rye, oats, rice, or barley, and shall be free of visible decay and insects.

AR103.3.2 Clay soil. Suitability of clay soil shall be determined in accordance with the Figure 2 Ribbon Test or the Figure 3 Ball Test of the Appendix to ASTM E2392/E2392M.

AR103.3.3 Clay slip. Clay slip shall be of sufficient viscosity such that a finger dipped in the slip and withdrawn remains coated with an opaque coating.

AR103.3.4 Light straw-clay mixture. Light straw-clay shall contain a not less than 65% and not more than 85% straw, by volume of bale-compacted straw to clay soil. Loose straw shall be mixed and coated with clay slip such that there is not more than 5% uncoated straw.

AR103.4 Wall Construction. Light straw-clay wall construction shall be in accordance with the requirements of Sections AR103.4.1 through AR103.4.7.

AR103.4.1 Light straw-clay maximum thickness. Light straw-clay shall be not more than 12 inches (305 mm) thick, to allow adequate drying of the installed material.

AR103.4.2 Distance above grade. Light straw-clay and its exterior finish shall be not less than 8 inches (203 mm) above exterior finished grade.

AR103.4.3 Moisture barrier. An *approved* moisture barrier shall separate the bottom of light straw-clay walls from any masonry or concrete foundation or slab that directly supports the walls. Penetrations and joints in the barrier shall be sealed with an *approved* sealant.

AR103.4.4 Contact with wood members. Light straw clay shall be permitted to be in contact with untreated wood members.

AR103.4.5 Contact with non-wood structural members. Non-wood structural members in contact with light straw-clay shall be resistant to corrosion or shall be coated to prevent corrosion with an *approved* coating.

AR103.4.6 Installation. Light straw-clay shall be installed in accordance with the following:

1. Formwork shall be sufficiently strong to resist bowing when the light straw-clay is compacted into the forms.
2. Light straw-clay shall be uniformly placed into forms and evenly tamped to achieve stable walls free of voids. Light straw-clay shall be placed in lifts of no more than 6 inches (152 mm) and shall be thoroughly tamped before additional material is added.
3. Formwork shall be removed from walls within 24 hours after tamping, and walls shall remain exposed until moisture content is in accordance with Section AR103.5.1. Any visible voids shall be patched with light straw-clay prior to plastering.

AR103.4.7 Openings in Walls. Openings in walls shall be in accordance with the following:

1. Rough framing for doors and windows shall be fastened to structural members in accordance with the -*International Residential Code*. Windows and doors shall be flashed in accordance with the *International Residential Code*.
2. An *approved* moisture barrier shall be installed at window sills in light straw-clay walls prior to installation of windows.

AR103.5 Wall Finishes. The interior and exterior surfaces of light straw-clay walls shall be protected with a finish in accordance with Sections AR103.5.1 through AR103.5.5.

AR103.5.1 Moisture content of light straw-clay prior to application of finish. Light straw-clay walls shall be dry to a moisture content of not more than 20% at a depth of 4 inches (102 mm), as measured from each side of the wall, prior to the application of finish on either side of the wall. Moisture content shall be measured with a moisture meter equipped with a probe that is designed for use with baled straw or hay.

AR103.5.2 Plaster finish. Exterior plaster finishes shall be clay plaster or lime plaster. Interior plaster finishes shall be clay plaster, lime plaster, or gypsum plaster. Plasters shall be permitted to be applied directly to the surface of the light straw-clay walls without reinforcement, except that the juncture of dissimilar substrates shall be in accordance with Section AR103.5.3. Plasters shall have a thickness of not less than ½ inch (13 mm) and not more than 1 inch (25 mm) and shall be installed in no less than 2 coats. Exterior clay plaster shall be finished with a lime-based or silicate-mineral coating.

AR103.5.3 Separation of wood and plaster. Where wood framing occurs in light straw-clay walls, such wood surfaces shall be separated from exterior plaster with No.15 asphalt felt, grade D paper, or other *approved* material except where the wood is *preservative-treated* or *naturally durable*.

Exception: Exterior clay plasters shall not be required to be separated from wood.

AR103.5.4 Bridging across dissimilar substrates. Bridging shall be installed across dissimilar substrates prior to the application of plaster. Acceptable bridging materials include: expanded metal lath, woven wire mesh, welded wire mesh, fiberglass mesh, reed matting, or burlap. Bridging shall extend not less than 4 inches (102 mm), on both sides of the juncture.

AR103.5.5 Exterior siding. Exterior wood, metal, or composite material siding shall be spaced at least 3/4 inch (19 mm) from the light straw-clay such that a ventilation space is created to allow for moisture diffusion. The siding shall be fastened to wood furring strips in accordance with manufacturer's recommendations. Furring strips shall be spaced not more than 32 inches (813 mm) on center, and shall be securely fastened to the vertical wall reinforcing or structural framing. Insect screening shall be provided at the top and bottom of the ventilation space. An *air barrier* consisting of not more than 3/8" thick clay plaster or lime plaster shall be applied to the light straw-clay prior to application of siding.

SECTION AR104
THERMAL INSULATION

AR104.1 R-value. Light straw-clay, where installed in accordance with this appendix, shall be deemed to have an R-value of 1.6 per inch.

SECTION AR105
REFERENCED STANDARDS

ASTM E 2392/E 2392M-10 Standard Guide for Design of Earthen Wall Building Systems AR104.1

Reason: The purpose of the proposed code change is to include Light Straw Clay as a nonload-bearing building material and wall infill system into the IRC because no such section currently exists.

Light straw-clay construction has proven to be a viable, ecologically sound, and energy efficient building method. To date, permitting of light straw-clay construction has generally been left to the discretion of individual building officials on a case-by-case basis. Two exceptions are the State of New Mexico and the State of Oregon. Since 1998 the State of New Mexico has successfully permitted straw-clay construction using its standard permitting process when a project complies with its "Clay Straw Guidelines".

The proposed light straw-clay section of the IBC is derived from and builds upon the fourteen years of success of New Mexico's Clay Straw Guidelines. In October of 2011 the Oregon Reach Code (ORC) was amended to include light straw-clay construction. Inclusion in the IBC would make proven provisions accessible to more designers and builders interested in using this environmentally beneficial material and to building officials who will be evaluating and enforcing its proper use.

The proposed mixture of clay and straw as a monolithic non-load bearing building enclosure has been successfully used in the United States since 1990 and since 1950 in Europe. Prior to this a heavier form of clay, straw, and woven wood construction known as wattle and daub was in common use throughout Europe, Africa, Asia, and North and South America. Many thousands of existing structures dating back 300-400 years have been continuously occupied, attesting to the durability of these natural materials. In the United States residential and non-residential structures using straw-clay have been completed in 17 states, and most of those have been constructed with full permits and inspections.

The centuries old European predecessors and light straw clay buildings built to date in North America have all been constructed without the use of a moisture barrier. The proposed light straw clay materials are vapor permeable and do not require a moisture barrier. Code precedents for vapor permeable construction exist for adobe construction, log construction and half-timber construction. In these systems as in light straw clay construction there is sufficient hygric capacity to hold and re-release moisture without damage to structural members or degradation of the wall due to weather related moisture fluctuations. Furthermore for exterior siding applications, with ventilated space and rain screen a water resistive barrier is not necessary.

Through The EcoNest Company, and as a licensed architect for over 25 years, I have been involved in the design and/or construction of over 50 buildings utilizing light straw-clay construction. In 2005 I co-authored, with my husband and business partner Robert Laporte, the book "Econest, Creating Sustainable Sanctuaries of Clay, Straw and Timber".

Official guidelines for straw-clay construction have been in effect in New Mexico since 1998. At least 20 residential structures have been successfully permitted and built since that time in New Mexico following these guidelines. Other building officials in surrounding States have also permitted straw-clay construction in their jurisdictions based on these guidelines.

In 2004 the Canada Mortgage and Housing Corporation (CMHC) funded a study to explore the material characteristics of Straw Light Clay (SLC) construction. The proposed section for the IBC uses this study as well as the many years of experience of our company and other practitioners of light straw-clay construction as its basis. The CMHC study includes issues of thermal performance, fire-resistance, moisture, and vapor permeability. The CMHC study and other supporting documentation is available for viewing and download at: http://www.econesthomes.com/natural-building-resources/technical/. EcoNest's numerous projects utilizing light straw-clay construction can be viewed at www.econesthomes.com

Bibliography:

2011 Oregon Reach Code (Section 1307) (Based on 2012 International Green Construction Code)
Baker-Laporte, Laporte (2005) *Econest, Creating Sustainable Sanctuaries of Clay, Straw and Timber*, Gibbs Smith Publishers (This book is available only by purchase. See http://www.econesthomes.com/bookstore/)
J. Thornton (2004) *Initial Material Characterization of Straw Light Clay* Canada Mortgage and Housing Corporation
State of New Mexico Construction Industries Division (2001) *Clay Straw Guidelines*
Richard Duncan PE, Resistance to Out-Of -Plane Lateral Forces of Light Straw Clay Wall Infill

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, [ASTM E2392/E2392M-10] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB471-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

APPENDIX AR (NEW)-RB-BAKER_LAPORTE

RB472 – 13
Appendix R (New)

Proponent: Michael Cudahy, Plastic Pipe and Fittings Association representing the Plastic Pipe and Fittings Association (PPFA) (mikec@cmservnet.com)

Add new appendix and text as follows:

APPENDIX R

PIPING STANDARDS FOR VARIOUS APPLICATIONS

SECTION AR101
PLASTIC PIPING STANDARDS

AR101.1 Plastic piping. Table AR101.1 provides a listing of plastic piping product standards for various applications.

TABLE AR101.1
PLASTIC PIPING STANDARDS
FOR
VARIOUS APPLICATIONS[a,b]

APPLICATION	LOCATION	TYPE OF PLASTIC PIPING								
		ABS	CPVC	PE	PE-AL-PE	PE-RT	PEX	PEX-AL-PEX	PP	PVC
CENTRAL VACUUM	SYSTEM PIPING	-	-	-	-	-	-	-	-	ASTM F2158
FOUNDATION DRAINAGE	SYSTEM PIPING	ASTM F628	-	ASTM F405	-	-	-	-	-	ASTM D2665 ASTM D2729 ASTM D3034
GEOTHERMAL GROUNDLOOP	SYSTEM PIPING	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846 CSA B137.6	ASTM D2239 ASTM D2737 ASTM D3035	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11	ASTM D1785 ASTM D2241 CSA B137.3

APPLICATION	LOCATION	TYPE OF PLASTIC PIPING								
		ABS	**CPVC**	**PE**	**PE-AL-PE**	**PE-RT**	**PEX**	**PEX-AL-PEX**	**PP**	**PVC**
	LOOP PIPING	-	-	ASTM D2239 ASTM D2737 ASTM D3035 NSF 358-1	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	-	ASTM F2389 CSA B137.11	-
GRAY WATER	NON-PRESS-URE DISTRIBU-TION / COLLEC-TION	ASTM F628	-	ASTM D2239 ASTM D2737 ASTM D3035 ASTM F2306	-	-	-	-	ASTM F2389 CSA B137.11	ASTM F891 ASTM D2949 ASTM D1785 ASTM D2729 ASTM D3034 ASTM F1760 CSA B137.3
	PRESS-URE / DISTRIBU-TION	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846 CSA B137.6	ASTM D2239 ASTM D2737 ASTM D3035	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11	ASTM D1785 ASTM D2241 CSA B137.3
RADIANT COOLING	LOOP PIPING	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846	ASTM D2239 ASTM D2737 ASTM D3035	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11	-
RADIANT HEATING	LOOP PIPING	-	ASTM	-	ASTM F1282	ASTM F2623	ASTM F876	ASTM F1281	ASTM F2389	-

APPLICATION	LOCATION	TYPE OF PLASTIC PIPING								
		ABS	CPVC	PE	PE-AL-PE	PE-RT	PEX	PEX-AL-PEX	PP	PVC
			F441 ASTM F442 ASTM F2855 ASTM D2846			ASTM F2769	CSA B137.5		CSA B137.11	
RAINWATER HARVESTING	NON-PRESS-URE / COLLEC-TION	ASTM F628	-	ASTM F1901	-	-	-	-	ASTM F2389 CSA B137.11	ASTM F891 ASTM D2949 ASTM D1785 ASTM D2729 ASTM F1760 CSA B137.3
	PRESS-URE / DISTRIBU-TION	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846 CSA B137.6	ASTM D2239 ASTM D2737 ASTM D3035	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11	ASTM D1785 ASTM D2241 CSA B137.3
RADON VENTING	SYSTEM PIPING	ASTM F628	-	-	-	-	-	-	-	ASTM F891 ASTM D1785 ASTM F1760

APPLICATION	LOCATION	TYPE OF PLASTIC PIPING								
		ABS	CPVC	PE	PE-AL-PE	PE-RT	PEX	PEX-AL-PEX	PP	PVC
RECLAIMED WATER	MAIN TO BUILDING SERVICE	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846 CSA B137.6	ASTM D3035 AWWA C901 CSA B137.1	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 AWWA C904 CSA B137.5	-	ASTM F2389 CSA B137.11	ASTM D1785 ASTM D2241 AWWA C905 CSA B137.3
	PRESS-URE / DISTRIBU-TION / IRRIGA-TION	-	ASTM F441 ASTM F442 ASTM F2855 ASTM D2846 CSA B137.6	ASTM D2239 ASTM D2737 ASTM D3035	ASTM F1282	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11 AWWA C900	ASTM D1785 ASTM D2241 AWWA C900
RESIDENTIAL FIRE SPRINKLERS[c]	SPRINK-LER PIPING	-	ASTM F441 ASTM F442 CSA B137.6 UL 1821	-	-	ASTM F2769	ASTM F876 CSA B137.5 UL 1821		ASTM F2389 CSA B137.11	-
SOLAR HEATING	PRESS-URE / DISTRIBU-TION		ASTM F441 ASTM F442 ASTM F2855 ASTM D2846	-	-	ASTM F2623 ASTM F2769	ASTM F876 CSA B137.5	ASTM F1281	ASTM F2389 CSA B137.11	-

a. This table indicates manufacturing standards for plastic piping materials that are suitable for use in the applications indicated. Such applications support green and sustainable building practices. The system designer or the installer of piping shall verify that the piping chosen for an application complies with local codes and the recommendations of the manufacturer of the piping.
b. Fittings applicable for the piping shall be as recommended by the manufacturer of the piping.
c. Piping systems for fire sprinkler applications shall be listed for the application.

Add standards to Chapter 44 as follows:

ASTM

F1760-01(2011)	Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
F1901-10	Standard Specification for Polyethylene (PE) Pipe and Fittings for Roof Drain Systems
F2158-08	Standard Specification for Residential Central-Vacuum Tube and Fittings
F2306-08	12" to 60" Annular Corrugated Profile-wall Polyethylene (PE) Pipe and Fittings for Gravity Flow Storm Sewer and Subsurface Drainage Applications
F2623-08	Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDR 9 Tubing
F2855-12	Standard Specification for Chlorinated Poly(Vinyl Chloride)/Aluminum/Chlorinated Poly(Vinyl Chloride) (CPVC-AL-CPVC) Composite Pressure Tubing

AWWA

900-07	Polyvinyl chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (350mm through 1200mm), for Water transmission and Distributuion
905-10	Polyvinyl chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (100 mm through 300mm)

NSF

358-1-2012	Polyethylene Pipe and Fittings for Water-Based Ground-Source "Geothermal" Heat Pump Systems

UL

1821-2011	Standard for Thermoplastic Sprinkler Pipe and Fittings for Fire Protection Service

Reason: PPFA is recommending that this table to be added as an appendix. The table will assist builders and code officials to properly select and inspect plastic piping used in green and sustainable piping systems that may be encouraged or required due to other codes, standards or rating systems. These systems are often not covered in the model codes, and some guidance would improve the code until all the applications are covered in the code body.

Cost Impact: None

Analysis: A review of the standards proposed for inclusion in the code, ASTM F1760, F1901, F2158 and F2855; AWWA C900 and C905; NSF 358-1 and UL 1821 with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1 2013. The following standards proposed for inclusion in the code are already referenced by other 2012 I-codes: ASTM F2306 (IPC) and F2623 (IMC).

RB472-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

APPENDIX R (NEW)-RB-CUDAHY.DOC

RB473 – 13
Appendix R (New)

Proponent: Martin Hammer, representing: California Straw Building Association, Colorado Straw Bale Association, Straw Bale Construction Association – New Mexico, Ontario Straw Bale Building Coalition, Development Center for Appropriate Technology and Ecological Building Network (mfhammer@pacbell.net)

Add new text as follows:

APPENDIX R
STRAWBALE CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION AR101
GENERAL

AR101.1 Scope. This appendix provides prescriptive and performance-based requirements for the use of baled straw as a building material. Other methods of strawbale construction shall be subject to approval in accordance with Section 104.11 of the *International Residential Code*. Buildings using strawbale walls shall comply with the *International Residential Code* except as otherwise stated in this appendix.

SECTION AR102
DEFINITIONS

AR102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions.

BALE. Equivalent to *straw bale*.

CLAY. Inorganic soil with particle sizes less than 0.00008 in. (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity.

CLAY SLIP. A suspension of *clay* particles in water.

FINISH. Completed compilation of materials on the interior or exterior faces of stacked *bales*.

FLAKE. An intact section of compressed *straw* removed from an untied *bale*.

LAID FLAT. The orientation of a *bale* with its largest faces horizontal, its longest dimension parallel with the wall plane, its *ties* concealed in the unfinished wall and its *straw* lengths oriented across the thickness of the wall.

LOAD-BEARING WALL. A strawbale wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition its own weight.

MESH. An openwork fabric of linked strands of metal, plastic, or natural or synthetic fiber, embedded in plaster.

NONSTRUCTURAL WALL. All walls other than *load-bearing walls* or *shear walls*.

ON-EDGE. The orientation of a *bale* with its largest faces vertical, its longest dimension parallel with the wall plane, its *ties* on the face of the wall, and its *straw* lengths oriented vertically.

PIN. A vertical metal rod, wood dowel, or bamboo, driven into the center of stacked *bales*, or placed on opposite surfaces of stacked *bales* and through-tied.

PLASTER. Gypsum or cement plaster, as defined in Section R702 and in Section AR104, or clay plaster, soil-cement plaster, lime plaster, or cement-lime plaster as defined in Section AR104.

PRE-COMPRESSION. Vertical compression of stacked *bales* before the application of *finish*.

REINFORCED PLASTER. A plaster containing mesh reinforcement.

RUNNING BOND. The placement of *straw bales* such that the head joints in successive courses are offset at least one-quarter the bale length.

SHEAR WALL. A *strawbale* wall designed and constructed to resist lateral seismic and wind forces parallel to the plane of the wall in accordance with Section AR106.13.

SKIN. The compilation of *plaster* and reinforcing, if any, applied to the surface of stacked bales.

STRUCTURAL WALL. A wall that meets the definition for a *load-bearing wall* or *shear wall*.

STACK BOND. The placement of *straw bales* such that head joints in successive courses are vertically aligned.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

STRAW BALE. A rectangular compressed block of *straw*, bound by *ties*.

STRAWBALE. The adjective form of *straw bale*.

STRAW-CLAY. Loose *straw* mixed and coated with *clay slip*.

TIE. A synthetic fiber, natural fiber, or metal wire used to confine a *straw bale*.

TRUTH WINDOW. An area of a *strawbale* wall left without its *finish*, to allow view of the *straw* otherwise concealed by its *finish*.

SECTION AR103
BALES

AR103.1 Shape. Bales shall be rectangular in shape.

AR103.2 Size. Bales shall have a minimum height and thickness of 12 inches (305 mm), except as otherwise permitted or required in this appendix. Bales used within a continuous wall shall be of consistent height and thickness to ensure even distribution of loads within the wall system.

AR103.3 Ties. Bales shall be confined by synthetic fiber, natural fiber, or metal ties sufficient to maintain required bale density. Ties shall be not less than 3 inches (76 mm) and not more than 6 inches (152 mm) from the two faces without ties and shall be spaced not more than 12 (305 mm) inches apart. Bales with broken ties shall be retied with sufficient tension to maintain required bale density.

AR103.4 Moisture content. The moisture content of bales at the time of application of the first coat of plaster or the installation of another finish shall not exceed 20 percent of the weight of the bale. The moisture content of bales shall be determined by use of a moisture meter designed for use with baled straw or hay, equipped with a probe of sufficient length to reach the center of the bale. At least 5 percent and not less than ten bales used shall be randomly selected and tested.

AR103.5 Density. Bales shall have a minimum dry density of 6.5 pounds per cubic foot (104 kg/cubic meter). The dry density shall be calculated by subtracting the weight of the moisture in pounds (kg) from the actual bale weight and dividing by the volume of the bale in cubic feet (cubic meters). At least 2 percent and not less than five bales to be used shall be randomly selected and tested on site.

AR103.6 Partial bales. Partial bales made after original fabrication shall be retied with ties complying with Section AR103.3.

AR103.7 Types of straw. Bales shall be composed of straw from wheat, rice, rye, barley, or oat.

AR103.8 Other baled material. The dry stems of other cereal grains shall be acceptable when *approved* by the *building official*.

SECTION AR104
FINISHES

AR104.1 General. Finishes applied to strawbale walls shall be any type permitted by the *International Residential Code*, and shall comply with this section and with Chapters 3 and 7 of the *International Residential Code* unless stated otherwise in this section.

AR104.2 Purpose, and where required. Strawbale walls shall be finished so as to provide mechanical protection, fire resistance, protection from weather, and to restrict the passage of air through the bales, in accordance with this appendix and the *International Residential Code*. Vertical strawbale wall surfaces shall receive a coat of plaster not less than 3/8 inches (10 mm) thick, or greater where required elsewhere in this appendix, or shall fit tightly against a solid wall panel. The tops of strawbale walls shall receive a coat of plaster not less than 3/8 inches (10 m) thick where straw would otherwise be exposed.

Exception: Truth windows shall be permitted where a fire-resistive rating is not required. Weather-exposed truth windows shall be fitted with a weather-tight cover. Interior truth windows in Climate Zones 5, 6, 7, 8, and Marine 4 shall be fitted with an air-tight cover.

AR104.3 Vapor retarders. Class I and Class II vapor retarders shall not be used on a strawbale wall, nor shall any other material be used that has a vapor permeance rating of less than 3 perms, except as permitted or required elsewhere in this appendix.

AR104.4 Plaster. Plaster applied to bales shall be any type described in this section, and as required or limited in this appendix. Plaster thickness shall not exceed 2 inches (51 mm).

AR104.4.1 Plaster and membranes. Plaster shall be applied directly to strawbale walls to facilitate transpiration of moisture from the bales, and to secure a mechanical bond between the *skin* and the bales, except where a membrane is allowed or required elsewhere in this appendix.

AR104.4.2 Lath and mesh for plaster. The surface of the straw bales functions as lath, and no other lath or mesh shall be required, except as required for out-of-plane resistance by Table 105.4, or for *structural walls* by Table AR106.12 and Table AR106.13(1).

AR104.4.3 Clay plaster. Clay plaster shall comply with Sections AR104.4.3.1 through AR104.4.3.6.

AR104.4.3.1 General. Clay plaster shall be any plaster having a clay or clay-soil binder. Such plaster shall contain sufficient clay to fully bind the plaster, sand or other inert granular material, and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal, and animal hair.

AR104.4.3.2 Lath and mesh. Clay plaster shall not be required to contain reinforcing lath or mesh except as required in Table AR105.4 and Table AR106.13(1). Where provided, mesh shall be natural fiber, corrosion-resistant metal, nylon, high-density polypropylene, or other *approved* material.

AR104.4.3.3 Thickness and coats. Clay plaster shall be not less than 1 inch (25 mm) thick, except where required to be thicker for *structural walls*, as described elsewhere in this appendix, and shall be applied in not less than two coats.

AR104.4.3.4 Rain-exposed. Clay plaster, where exposed to rain, shall be finished with lime wash, lime plaster linseed oil, or other *approved* erosion-resistant finish.

AR104.4.3.5 Prohibited finish coat. Plaster containing Portland cement shall not be permitted as a finish coat over clay plasters.

AR104.4.3.6 Plaster additives. Additives shall be permitted to increase plaster workability, durability, strength, or water resistance.

AR104.4.4 Soil-cement plaster. Soil-cement plaster shall comply with Sections AR104.4.4.1 through AR104.4.4.3.

AR104.4.4.1 General. Soil-cement plaster shall be comprised of soil (free of organic matter), sand, and not less than 10 percent and not more than 20 percent Portland cement by volume, and shall be permitted to contain reinforcing fibers.

AR104.4.4.2 Lath and mesh. Soil-cement plaster shall use any corrosion-resistant lath or mesh permitted by the *International Residential Code*, or as required in Section AR106 where used on *structural walls*.

AR104.4.4.3 Thickness. Soil-cement plaster shall be not less than 1 inch (25 mm) thick.

AR104.4.5 Gypsum plaster. Gypsum plaster shall comply with Section R702. Gypsum plaster shall be limited to use on interior surfaces of non-structural walls, and as an interior finish coat over a structural plaster that complies with this appendix.

AR104.4.6 Lime plaster. Lime plaster shall comply with Sections AR104.4.6.1 and AR104.4.6.3.

AR104.4.6.1 General. Lime plaster is any plaster whose binder is comprised of calcium hydroxide (CaOH) including Type N or Type S hydrated lime, hydraulic lime, natural hydraulic lime, or quicklime. Hydrated lime shall comply with ASTM C 206. Hydraulic lime shall comply with ASTM C 1707. Natural hydraulic lime shall comply with ASTM C 141 and EN 459. Quicklime shall comply with ASTM C 5.

AR104.4.6.2 Thickness and coats. Lime plaster shall be not less than 7/8 inch (22 mm) thick, and shall be applied in not less than three coats.

AR104.4.6.3 On structural walls. Lime plaster on strawbale *structural walls* in accordance with Table AR106.12 or Table AR106.13(1) shall use a binder of hydraulic or natural hydraulic lime.

AR104.4.7 Cement-lime plaster. Cement-lime plaster shall be plaster mixes CL, F, or FL as described in ASTM C 926.

AR104.4.8 Cement plaster. Cement plaster shall conform to ASTM C 926 and shall comply with Sections R703.6.2, R703.6.4 and R703.6.5, except that the amount of lime in all plaster coats shall be not less than 1 part lime to 6 parts cement to allow a minimum acceptable vapor permeability. The combined thickness of all plaster coats shall be not more than 1 1/2 inch (38 mm) thick.

SECTION AR105
STRAWBALE WALLS – GENERAL

AR105.1 General. Strawbale walls shall be designed and constructed in accordance with this section.

Strawbale *structural walls* shall be in accordance with the additional requirements of Section AR106.

AR105.2 Building requirements for use of strawbale nonstructural walls. Buildings using strawbale *nonstructural walls* shall be subject to the following limitations and requirements:

1. Number of stories: not more than one, except that two stories shall be allowed with an *approved* engineered design.
2. Building height: not more than 25 feet (7620 mm)
3. Wall height: in accordance with Table AR105.4
4. Braced wall panel length, and increase in seismic design categories C, D_0, D_1 and D_2: the required length of bracing for buildings using strawbale *nonstructural walls* shall comply with Section R602.10.3 of the *International Residential Code*, with the additional requirements that Table 602.10.3(3) shall be applicable to all buildings in Seismic Design Category C, and that the minimum total length of *braced wall panels* in Table R602.10.3(3) shall be increased by 60 percent.

AR105.3 Sill plates. Sill plates shall support and be flush with each face of the straw bales above and shall be of *naturally durable* or *preservative-treated wood* where required by the *International Residential Code*. Sill plates shall be not less than nominal 2 inches by 4 inches (51 mm by 102 mm) with anchoring complying with Section R403.1.6 and the additional requirements of Tables AR105.4 and AR106.16(1) where applicable.

AR105.4 Out-of-plane resistance and unrestrained wall dimensions. Strawbale walls shall employ a method of out-of-plane resistance in accordance with Table AR105.4, and comply with its associated limits and requirements.

AR105.4.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AR105.4 shall be in terms of the design wind speed and seismic design category as determined in accordance with Sections R301.2.1 and R301.2.2 of the *International Residential Code*.

TABLE AR105.4
OUT-OF-PLANE RESISTANCE AND UNRESTRAINED WALL DIMENSIONS

Method of Out-of-Plane Resistance[a]	For Wind Design Speeds (mph)	For Seismic Design Categories	Unrestrained Wall Dimensions, H[b]		Mesh Staple Spacing at Boundary Restraints
			Absolute limit in feet	Limit based on bale thickness T[c] in feet (mm)	
Non-plaster finish or unreinforced plaster	≤100	A, B, C, D_0	H ≤ 8	H ≤ 5T	none required
Pins per Section AR105.4.2	≤100	A, B, C, D_0	H ≤ 12	H ≤ 8T	none required
Pins per Section AR105.4.2	≤110	A, B, C, D_0, D_1, D_2	H ≤ 10	H ≤ 7T	none required
Reinforced[c] clay plaster	≤110	A, B, C, D_0, D_1, D_2	H ≤ 10	$H \le 8T^{0.5}$ ($H \le 140T^{0.5}$)	≤ 6 inches
Reinforced[c] clay plaster	≤110	A, B, C, D_0, D_1, D_2	10 < H ≤ 12	$H \le 8T^{0.5}$ ($H \le 140T^{0.5}$)	≤ 4 inches[e]
Reinforced[c] cement, cement-lime, lime, or soil-cement plaster	≤110	A, B, C, D_0, D_1, D_2	H ≤ 10	$H \le 9T^{0.5}$ ($H \le 157T^{0.5}$)	≤ 6 inches
Reinforced[c] cement, cement-lime, lime, or soil-cement plaster	≤120	A, B, C, D_0, D_1, D_2,	H ≤ 12	$H \le 9T^{0.5}$ ($H \le 157T^{0.5}$)	≤ 4 inches[e]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

a. Finishes applied to both sides of stacked bales. Where different finishes are used on opposite sides of a wall, the more restrictive requirements shall apply.
b. H = stacked bale height in feet (mm) between sill plate ant top plate or other *approved* horizontal restraint, or the horizontal distance in feet (mm) between *approved* vertical restraints. For load-bearing walls, H refers to vertical height only.
c. T= bale thickness in feet (mm).
d. Plaster reinforcement shall be any mesh allowed in Table AR106.16 for the matching plaster type, but with staple spacing per this table. Mesh shall be installed in accordance with Section AR106.9.
e. Sill plate attachment shall be with 5/8 inch anchor bolts or *approved* equivalent at a maximum of 48 inches on center where staple spacing is required to be ≤ 4 inches.

AR105.4.2 Pins. Pins used for out-of-plane resistance shall comply with the following or shall be in accordance with an *approved* engineered design. Pins may be external, internal or a combination of the two.

1. Pins shall be 1/2 inch (13 mm) diameter steel, 3/4 inch (19 mm) diameter wood, or 1/2 inch (13 mm) diameter bamboo.
2. External pins shall be installed vertically on both sides of the wall at a spacing of not more than 24 inches (610 mm) on center. External pins shall have full lateral bearing on the sill plate and the top plate or roof-bearing element, and shall be tightly tied through the wall to an opposing pin with ties spaced not more than 32 inches (813 mm) apart and not more than 8 inches (203 mm) from each end of the pins.
3. Internal pins shall be installed vertically within the center third of the bales, at spacing of not more than 24 inches (610 mm) and shall extend from top course to bottom course. The bottom course shall be similarly connected to its support and the top course shall be similarly connected to the roof- or floor-bearing member above with pins or other *approved* means. Internal pins shall be continuous or shall overlap through not less than one bale course.

AR105.5 Connection of light-frame walls to strawbale walls. Light-frame walls perpendicular to, or at an angle to a straw bale wall assembly, shall be fastened to the bottom and top wood members of the strawbale wall in accordance with requirements for wood or cold-formed steel light-frame walls in the *International Residential Code*, or the abutting stud shall be connected to alternating straw bale courses with a 1/2 inch (13mm) diameter steel, 3/4" diameter (19 mm) wood, or 5/8" diameter (16 mm) bamboo dowel, with not less than 8 inch (203 mm) penetration.

AR105.6 Moisture control. Strawbale walls shall be protected from moisture intrusion and damage in accordance with Sections AR105.6.1 through AR105.6.8.

AR105.6.1 Water-resistive barriers and vapor permeance ratings. Plastered bale walls shall be constructed without any membrane barrier between straw and plaster to facilitate transpiration of moisture from the bales, and to secure a structural bond between straw and plaster, except as permitted or required elsewhere in this appendix. Where a water-resistive barrier is placed behind an exterior finish, it shall have a vapor permeance rating of not less than 5 perms, except as permitted or required elsewhere in this appendix.

AR105.6.2 Vapor retarders. Wall finishes shall have an equivalent vapor permeance rating of a Class III vapor retarder on the interior side of exterior strawbale walls in Climate Zones 5, 6, 7, 8 and Marine 4 as defined in Chapter 11. Bales in walls enclosing showers or steam rooms shall be protected on the interior side by a Class I or Class II vapor retarder.

AR105.6.3 Penetrations in exterior strawbale walls. Penetrations in exterior strawbale walls shall be sealed with an *approved* sealant or gasket on the exterior side of the wall in all Climate Zones, and on the interior side of the wall in Climate Zones 5, 6, 7, 8 and Marine 4 as defined in Chapter 11.

AR105.6.4 Horizontal surfaces. Bale walls and other bale elements shall be provided with a *water-resistive barrier* at all weather-exposed horizontal surfaces. The *water-resistive barrier* shall be of a material and installation that will prevent water from entering the wall system. Horizontal surfaces shall include exterior window sills, sills at exterior niches, and buttresses. The finish material at such surfaces shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain away from all bale walls and elements. Where the *water-resistive barrier* is below the finish material, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain to the outside surface of the bales wall's vertical finish.

AR105.6.5 Separation of bales and concrete. A sheet or liquid-applied Class II *vapor retarder* shall be installed between bales and supporting concrete or masonry. The bales shall be separated from the *vapor retarder* by not less than 3/4 inch (19 mm), and that space shall be filled with an insulating material such as wood or rigid insulation, or a material that allows vapor dispersion such as gravel, or other *approved* insulating or vapor dispersion material. Sill plates shall be installed at this interface in accordance with Section AR105.3. Where bales abut a concrete or masonry wall that retains earth, a Class II *vapor retarder* shall be provided between such wall and the bales.

AR105.6.6 Separation of bales and earth. Bales shall be separated from earth by not less than of 8" (203 mm).

AR105.6.7 Separation of exterior plaster and earth. Exterior plaster applied to straw bales shall be located not less than 6 inches (102 mm) above earth or 3 inches (51 mm) above paved areas.

AR105.6.8 Separation of wood and plaster. Where wood framing or wood sheathing occurs on the exterior face of strawbale walls, such wood surfaces shall be separated from exterior plaster with 2 layers of grade D paper, No. 15 asphalt felt, or other *approved* material in accordance with Section R703.6.3.

Exceptions:

1. Where the wood is preservative-treated or *naturally durable* and is no greater than 1-1/2 inches (38 mm) in width.

2. Clay plaster shall not be required to be separated from untreated wood that is no greater than 1-1/2 inches (38 mm) in width.

AR105.7 Inspections. The *building official* shall inspect the following aspects of strawbale construction in accordance with Section R109.1:

1. Sill plate anchors, as part of and in accordance with Section R109.1.1 Foundation inspection.

2. Mesh placement and attachment, where mesh is required by this appendix.

3.*Pins,* where required by and in accordance with Section AR105.4.

SECTION AR106
STRAWBALE WALLS - STRUCTURAL

AR106.1 General. Plastered strawbale walls shall be permitted to be used as *structural walls* in one-story buildings in accordance with the prescriptive provisions of this section.

AR106.2 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301 of the *International Residential Code*. Strawbale wall dead loads shall not exceed 60 psf (2872 N/m^2) per face area of wall.

AR106.3 Foundations. Foundations for plastered strawbale walls shall be in accordance with Chapter 4.

AR106.4 Configuration of bales. Bales in strawbale *structural walls* shall be *laid flat* or *on-edge* and in a *running bond* or *stack bond*, except that bales in *structural walls* with unreinforced plasters shall be laid in a *running bond* only.

AR106.5 Voids and stuffing. Voids between bales in strawbale *structural walls* shall not exceed 4 inches (102 mm) in width, and such voids shall be stuffed with *flakes* of straw or *straw-clay*, before application of finish.

AR106.6 Plaster on structural walls. Plaster on *load-bearing* walls shall be in accordance with Table AR106.12. Plaster on *shear walls* shall be in accordance with Table AR106.13(1).

AR106.6.1 Compressive strength. For plasters on strawbale *structural walls*, the *building official* is authorized to require a 2 inch (51mm) cube test conforming with ASTM C 109 to demonstrate a minimum compressive strength in accordance with Table AR106.6.1.

TABLE AR106.6.1
MINIMUM COMPRESSIVE STRENGTH FOR PLASTERS ON STRUCTURAL WALLS

PLASTER TYPE	MINIMUM COMPRESSIVE STRENGTH (psi)
Clay	100
Soil-cement	1000
Lime	600
Cement-lime	1000
Cement	1400

For SI: 1 pound per square inch = 6894.76 N/m^2.

AR106.7 Straightness of plaster. Plaster on strawbale *structural walls* shall be straight, as a function of the bale wall surfaces they are applied to, in accordance with the following:

1. As measured across the face of a bale, straw bulges shall not protrude more than 3/4 inch (19 mm) across 2 feet (610 mm) of its height or length,
2. As measured across the face of a bale wall, straw bulges shall not protrude from the vertical plane of a bale wall more than 2 inches (51 mm) over 8 feet (2438 mm), and
3. The vertical faces of adjacent bales shall not be offset more than 3/8 inch (10 mm).

AR106.8 Plaster and membranes. Strawbale *structural walls* shall not have a membrane between straw and plaster, or shall have attachment through the bale wall from one plaster *skin* to the other in accordance with an *approved* engineered design.

AR106.9 Mesh. Mesh in plasters on strawbale *structural walls*, and where required by Table AR105.4, shall be installed in accordance with Sections AR106.9.1 through AR106.9.4.

AR106.9.1 Mesh laps. Mesh required by Tables AR106.12 or Table AR105.4 shall be installed with not less than 4-inch (102 mm) laps. Mesh required by Table AR106.13(1) or in walls designed to resist wind uplift of more than 100 plf (1459 N/m), shall run continuous vertically from sill plate to the top plate or roof-bearing element, or shall lap not less than 8 inches (203 mm). Horizontal laps in such mesh shall be not less than 4 inches (102 mm).

AR106.9.2 Mesh attachment. Mesh shall be attached with staples to top plates or roof-bearing elements and to sill plates in accordance with the following:

1. **Staples.** Staples shall be pneumatically driven, stainless steel or electro-galvanized, 16 gauge with 1 1/2-inch (38 mm) legs, 7/16-inch (11 mm) crown; or manually driven, galvanized, 15 gauge with 1-inch (25 mm) legs. Other staples shall be permitted to be used as designed by a *registered design professional*. Staples into preservative-treated wood shall be stainless steel.
2. **Staple orientation.** Staples shall be firmly driven diagonally across mesh intersections at the required spacing.
3. **Staple spacing.** Staples shall be spaced not more than 4-inches (102 mm) on center, except where a lesser spacing is required by Table AR106.13(1) or Section AR106.14 as applicable.

AR106.9.3 Steel mesh. Steel mesh shall be galvanized, and shall be separated from preservative-treated wood by grade D paper, 15# roofing felt, or other *approved* barrier.

AR106.9.4 Mesh in plaster. Required mesh shall be embedded in the plaster except where staples fasten the mesh to horizontal boundary elements.

AR106.10 Support of plaster skins. Plaster *skins* on strawbale *structural walls* shall be continuously supported along their bottom edge. Acceptable supports include: a concrete or masonry stem wall, a concrete slab-on-grade, a wood-framed floor blocked with an *approved* engineered design, or a steel angle anchored with an *approved* engineered design. A weep screed as described in R703.2.1 is not an acceptable support.

AR106.11 Transfer of loads to and from plaster skins. Where plastered strawbale walls are used to support superimposed vertical loads, such loads shall be transferred to the plaster *skins* by continuous direct bearing or by an *approved* engineered design. Where plastered strawbale walls are used to resist in-plane lateral loads, such loads shall be transferred to the reinforcing mesh from the structural member or assembly above and to the sill plate in accordance with Table AR106.13(3).

AR106.12 Load-bearing walls. Plastered strawbale walls shall be permitted to be used as *load-bearing walls* in one-story buildings to support vertical loads imposed according to Section R301, in accordance with and not more than the allowable bearing capacities indicated in Table AR106.12.
AR106.12.1 Pre-compression of load-bearing strawbale walls. Prior to application of plaster, walls designed to be *load-bearing* shall be pre-compressed by a uniform load of not less than 100 plf (1459 N/m).

AR106.12.2 Concentrated loads. Concentrated loads shall be distributed by structural elements capable of distributing the loads to the bearing wall within the allowable bearing capacity listed in Table AR106.12 for the plaster type used.

TABLE AR106.12
ALLOWABLE SUPERIMPOSED VERTICAL LOADS (LBS/FOOT)
FOR PLASTERED LOAD-BEARING STRAWBALE WALLS

WALL DESIGNATION	PLASTER[a] (both sides) Minimum thickness each side	MESH[b]	STAPLES[c]	ALLOWABLE BEARING CAPACITY[d] (plf)
A	Clay 1-1/2"	None required	None required	400
B	Soil-cement 1"	required	required	800
C	Lime 7/8"	required	required	500
D	Cement-lime 7/8"	required	required	800
E	Cement 7/8"	required	required	800

For SI: 1 inch=25.4mm, 1 pound per foot = 14.5939 N/m.
a. Plasters shall conform with Sections AR104.4.3through AR104.4.8, AR106.7, and AR106.10.
b. Any metal mesh allowed by this appendix and installed in accordance with Section AR106.9.
c. In accordance with Section AR106.9.2, except as required to transfer roof loads to the plaster skins in accordance with Section AR106.11.
d. For walls with a different plaster on each side, the lower value shall be used.

AR106.13 Braced panels. Plastered strawbale walls shall be permitted to be used as *braced wall panels* for one-story buildings in accordance with Section R602.10 of the *International Residential Code,* and with Tables AR106.13 (1), AR106.13(2) and AR106.13(3). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2.

AR106.13.1 Bale wall thickness. The thickness of the stacked bale wall without its plaster shall not be less than 15 inches (381 mm).

AR106.13.2 Sill plates. Sill plates shall be in accordance with Table AR106.13(1).

AR106.13.3 Sill plate fasteners. Sill plates shall be fastened with not less than 5/8-inch (16 mm) diameter steel anchor bolts with 3-inch by 3-inch by 3/16-inch steel washers, with not less than 7-inch embedment in a concrete or masonry foundation, or shall be an *approved* equivalent, with the spacing shown in Table AR106.13(1). Anchor bolts or other fasteners into framed floors shall be of an *approved* engineered design.

TABLE AR106.13(1)
PLASTERED STRAWBALE BRACED WALL PANEL TYPES

WALL DESIGNATION	PLASTER[a] (both sides)		SILL PLATES[b] (nominal size in inches)	ANCHOR BOLT[c] SPACING (on center)	MESH[d]	STAPLE SPACING[e] (on center)
	TYPE	THICK-NESS (minimum, each side)				
A1	Clay	1.5”	2 x 4	32”	None	None
A2	Clay	1.5”	2 x 4	32”	2” x 2” high-density polypropylene	2”
A3	Clay	1.5”	2 x 4	32”	2” x 2” x 14ga[f]	4”
B	Soil-cement	1”	4 x 4	24”	2” x 2” x 14ga[i]	2”
C1	Lime	7/8”	2 x 4	32”	17 ga woven wire	3”
C2	Lime	7/8”	4 x 4	24”	2” x 2” x 14ga[f]	2”
D1	Cement-lime	7/8”	4 x 4	32”	17 ga woven wire	2”
D2	Cement-lime	7/8”	4 x 4	24”	2” x 2” x 14ga[i]	2”
E1	Cement	7/8”	4 x 4	32”	2” x 2” x 14ga[l]	2”
E2	Cement	1.5”	4 x 4	24”	2 “ x 2” x 14ga[l]	2”

SI: 1 inch=25.4 mm

a. Plasters shall conform with Sections AR104.4.3 through AR104.4.8, AR106.7, AR106.8, and AR106.12.

b. Sill plates shall be Douglas fir-larch or southern pine and shall be *preservative-treated* where required by the *International Residential Code*.

c. Anchor bolts shall be in accordance with Section AR106.13.3 at the spacing shown in this table.

d. Installed in accordance with Section AR106.9.

e. Staples shall be in accordance with Section AR106.9.2 at the spacing shown in this table.

TABLE AR106.13(2)
BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS BASED ON WIND SPEED

• EXPOSURE CATEGORY B[d] • 25 FOOT MEAN ROOF HEIGHT • 10 FOOT EAVE-TO-RIDGE HEIGHT[d] • 10 FOOT WALL HEIGHT[d] • 2 BRACED WALL LINES[d]			MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]		
Basic Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Strawbale Braced Wall Panel[e] A2, A3**	**Strawbale Braced Wall Panel[e] C1, C2, D1**	**Strawbale Braced Wall Panel[e] D2, E1, E2**
≤ 85	One-story building	10	6.4	3.8	3.0
		20	8.5	5.1	4.0
		30	10.2	6.1	4.8
		40	13.3	6.9	5.5
		50	16.3	7.7	6.1
		60	19.4	8.3	6.6
≤ 90	One-story building	10	6.4	3.8	3.0
		20	9.0	5.4	4.3
		30	11.2	6.4	5.1
		40	15.3	7.4	5.9
		50	18.4	8.1	6.5
		60	21.4	8.8	7.0
≤ 100	One-story building	10	7.1	4.3	3.4
		20	10.2	6.1	4.8
		30	14.3	7.2	5.7
		40	18.4	8.1	6.5
		50	22.4	9.0	7.1
		60	26.5	9.8	7.8
≤ 110	One-story building	10	7.8	4.7	3.7
		20	12.2	6.6	5.3
		30	17.3	7.9	6.3
		40	22.4	9.0	7.1
		50	26.5	9.8	7.8
		60	31.6	11.4	8.5

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

a. Linear interpolation shall be permitted.

b. All braced wall panels shall be without openings and shall have an *aspect ratio* (H:L) ≤ 2:1.

c. Tabulated minimum total lengths are for braced wall lines using single braced wall panels with an *aspect ratio* (H:L) ≤ 2:1, or using multiple braced wall panels with *aspect ratios* (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an *aspect ratio* (H:L) > 1:1, the minimum total length shall be multiplied by the largest *aspect ratio* (H:L) of braced wall panels in that line.

d. Subject to applicable wind adjustment factors associated with “All methods” in Table R602.10.3(2)

e. Strawbale braced panel types indicated shall comply with AR106.13.1 through AR106.13.3 and with Table AR106.13(1)

TABLE AR106.17.4(2)
BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS
BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[d] • WALL HEIGHT = 10 FEET[d] • 15 PSF ROOF/CEILING DEAD LOAD[d] • BRACED WALL LINE SPACING ≤ 25 FEET[d]			MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]	
Seismic Design Category	**Story Location**	**Braced Wall Line Length (feet)**	**Strawbale Braced Wall Panel[e] A2, C1, C2, D1**	**Strawbale Braced Wall Panel[e] B, D2, E1, E2**
C	One-story building	10 20 30 40 50	5.7 8.0 9.8 12.9 16.1	4.6 6.5 7.9 9.1 10.4
D_0	One-story building	10 20 30 40 50	6.0 8.5 10.9 14.5 18.1	4.8 6.8 8.4 9.7 11.7
D_1	One-story building	10 20 30 40 50	6.3 9.0 12.1 16.1 20.1	5.1 7.2 8.8 10.4 13.0
D_2	One-story building	10 20 30 40 50	7.1 10.1 15.1 20.1 25.1	5.7 8.1 9.9 13.0 16.3

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.
a. Linear interpolation shall be permitted.
b. All braced wall panels shall be without openings and shall have an *aspect ratio* (H:L) ≤ 2:1.
c. Tabulated minimum total lengths are for braced wall lines using single braced wall panels with an *aspect ratio* (H:L) ≤ 2:1, or using multiple braced wall panels with *aspect ratios* (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an *aspect ratio* (H:L) > 1:1, the minimum total length shall be multiplied by the largest *aspect ratio* (H:L) of braced wall panels in that line.
d. Subject to applicable seismic adjustment factors associated with “All methods” in Table R602.10.3(4), except “Wall dead load”.
e. Strawbale braced wall panel types indicated shall comply with Sections AR106.13.1 through AR106.13.3 and with Table AR106.13(1)

AR106.14 Resistance to wind uplift forces. Plaster mesh in *skins* of strawbale walls that resist uplift forces from the roof assembly, as determined in accordance with Section R802.11, shall be in accordance with the following:

1. Plaster shall be any type and thickness allowed in Section AR 104.
2. Mesh shall be any type allowed in Table AR106.13(1), and shall be attached to top plates or roof-bearing elements and to sill plates in accordance with Section AR106.9.2.
3. Sill plates shall be a minimum nominal 2-inch by 4-inch (51 mm by 102 mm) with anchoring complying with Section R403.1.6.
4. Mesh attached with staples at 4 inches (51 mm) on center, shall be considered capable of resisting uplift forces of 100 plf (1459 N/m) for each plaster *skin*.
5. Mesh attached with staples at 2 inches (51 mm) on center, shall be considered capable of resisting uplift forces of 200 plf (2918 N/m) for each plaster *skin*.

SECTION AR107
FIRE RESISTANCE

AR107.1 Fire-resistance rating. Strawbale walls shall be considered to be non-rated, except for walls constructed in accordance with Section AR107.1.1 or AR107.1.2. Alternately, fire-resistance ratings of strawbale walls shall be determined in accordance with Section R302 of the *International Residential Code*.

AR107.1.1 1-hour rated clay plastered wall. 1-hour fire-resistance-rated non-load-bearing clay plastered strawbale walls shall comply with the following:

1. Bales shall be *laid flat* or *on-edge* in a *running bond*;
2. Bales shall maintain thickness of not less than 18 inches (457 mm);
3. Gaps shall be stuffed with *straw-clay*;
4. Clay plaster on each side of the wall shall be not less than 1 inch (25 mm) thick and shall be comprised of a mixture of 3 parts clay, 2 parts chopped straw, and 6 parts sand, or an alternative *approved* clay plaster; and
5. Plaster application shall be in accordance with AR104.4.3.3 for the number and thickness of coats.

AR107.1.2 2-hour rated cement plastered wall. 2-hour fire-resistance-rated non-load-bearing cement plastered strawbale walls shall comply with the following:

1. Bales shall be *laid flat* or *on-edge* in a *running bond*;
2. Bales shall maintain a thickness of not less than 14 inches (356 mm);
3. Gaps shall be stuffed with *straw-clay*;
4. 1 1/2 inch (38 mm) by 17 gauge galvanized woven wire mesh shall be attached to wood members with 1 1/2 inch (38 mm) staples at 6 inches (406 mm) on center. 9 gauge U-pins with minimum 8 inch (203 mm) legs shall be installed at 18 inches (457 mm) on center to fasten the mesh to the bales;
5. Cement plaster on each side of the wall shall be not less than 1 inch (25 mm) thick; and
6. Plaster application shall be in accordance with Section AR104.4.8 for the number and thickness of coats.

AR107.2 Openings in rated walls. Openings and penetrations in bale walls required to have a fire-resistance rating shall satisfy the same requirements for openings and penetrations as prescribed in the *International Residential Code*.

AR107.3 Clearance to fireplaces and chimneys. Strawbale surfaces adjacent to fireplaces or chimneys shall be finished with a minimum 3/8 inch (10 mm) thick plaster of any type permitted by this appendix. Clearance from the face of such plaster to fireplaces and chimneys shall be maintained as required from fireplaces and chimneys to combustibles in Chapter 10, or as required by manufacturer's installation instructions, whichever is more restrictive.

SECTION AR108
THERMAL INSULATION

AR108.1 R-value. The unit R-value of a strawbale wall with bales laid flat is R-1.3 per inch of bale thickness. The unit R-value of a strawbale wall with bales on-edge is R-2 per inch of bale thickness.

SECTION AR109
REFERENCED STANDARDS

ASTM

C 5 – 10	Standard Specification for Quicklime for Structural Purposes……….AR104.4.6.1
C 109/C 109M - 12	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars…. AR106.6.1
C 141 / C 141M – 09	Standard Specification for Hydrated Hydraulic Lime for Structural Purposes……………………………………………………………………AR104.4.6.1
C 206 – 03	Standard Specification for Finishing Hydrated Lime…………………..AR104.4.6.1

C 926 – 12a	Standard Specification for Application of Portland Cement Based Plaster……… AR104.4.7, AR104.4.8
C 1707 – 11	Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes…. AR104.4.6.1

EN	European Committee for Standardization Central Secretariat Rue de Stassart 36 B-10 50 Brussels

459 – 2010	Part 1: Building Lime. Definitions, Specifications and Conformity Criteria; Part 2: Test Methods….. AR104.4.6.1

Reason: Strawbale construction has proven to be a safe, durable, resource efficient, and fully viable method of construction. However, the International Residential Code (IRC) does not contain a section on strawbale construction, which has been an impediment to this construction system's proper and broader use.

First practiced in Nebraska in the late 1800's, with buildings over 100 years old still in service, strawbale construction was rediscovered in the 1980's in the American southwest. Since then it has been further developed and explored, including considerable testing and research regarding structural performance (under vertical and lateral loads), moisture, fire, and its thermal and acoustic properties.

Currently only New Mexico and Oregon have adopted statewide strawbale building codes. California has legislated strawbale construction guidelines for voluntary adoption by local jurisdictions. In addition, nine U.S. cities or counties have adopted strawbale building codes. Three countries outside of the United States – Germany, France, and Belarus - have limited strawbale building codes.

Most of the strawbale building codes that do exist are derived from the first such code, created for and adopted by Tucson / Pima County, Arizona in 1996. Much experience, testing and research since then have proven these codes to be deficient. They are often either too restrictive, or not restrictive enough, and in some cases don't address important issues at all.

Although strawbale codes are both few and flawed, strawbale buildings are now found in 49 of the 50 United States, and strawbale construction is practiced in over 45 countries throughout the world and in every climate. There are an estimated 600 strawbale buildings in California alone. The strawbale buildings in the U.S. include residences, public and private schools, libraries, office and retail buildings, wineries, multi-story buildings, buildings over 10,000 sq.ft in floor area, load-bearing strawbale structures, and structures in areas of high seismic risk (plastered strawbale walls are particularly resistant to earthquakes because they are energy-absorbing and tough). The practice of, and the desire to utilize strawbale construction, continues to increase and promises to accelerate as increased pressure is exacted on our environment and natural resources.

There is great need for a comprehensive strawbale code, with full benefit of the experience and knowledge that has been gained to date about this method of construction. The proposed Strawbale Construction appendix for the IRC was created to fulfill this need. It is based on the collective experience of the design, construction, and testing of strawbale buildings over 25 years by architects, engineers, builders, and academics throughout the U.S., Canada, and other countries throughout the world. The testing, research, and comprehensive understanding of the performance of strawbale buildings are summarized in the book *Design of Straw Bale Buildings* (B.King, et al, 2006, Green Building Press). Testing, research reports, and other supporting documentation are available for viewing and download at: http://www.ecobuildnetwork.org/strawbale-construction-code-supporting-documentation

As lead author of the proposed appendix, and as a licensed architect for 26 years, I have been involved in the design, construction, testing, and research of strawbale buildings since 1995. In 2001 I spearheaded legislation and revisions to the current California Guidelines for Straw-Bale Structures. The proposed Strawbale Construction appendix for the IRC has benefited from numerous peer reviews by experienced, licensed design and building professionals over the course of more than five years. It has also received input from other stakeholders including the Structural Engineers Association of California (SEAOC) and the National Association of Home Builders (NAHB). The proposed appendix would serve designers, builders, owners, inhabitants, and building officials alike in the construction and utilization of strawbale buildings.

Supporting Documentation: Selected documents that are available via the above link

Answers to Common Questions Regarding the IRC Strawbale Construction Proposal
Load-Bearing Straw Bale Construction – A summary of worldwide testing and experience, B.King, PE
Testing of Straw Bale Walls with Out-of-Plane Loads – K.Donahue, SE
In-Plane Cyclic Tests of Plastered Straw Bale Wall Assemblies – C.Ash, M.Aschheim, PE, D.Mar, SE
Structural Testing of Plastered Straw Bale Wall Assemblies – K.Lerner, Architect, K.Donahue, SE
Basis for Prescriptive Use of Plastered Strawbale Walls as Braced Panels in the IRC – M. Aschheim, PE
Shake Table Test Video of Full Scale Straw Bale Building Specimen – D.Donovan, PE
Moisture Properties of Plaster and Stucco for Strawbale Buildings – J.Straube, PE
Monitoring of Hygrothermal Performance of Strawbale Walls – J.Sraube, PE, C.Schumacher
ASTM E119 1-Hour Fire Resistance Test of a Non-Loadbearing Straw Bale Wall with Clay Plaster
ASTM E119 2-Hour Fire Resistance Test of a Non-Loadbearing Straw Bale Wall with Cement Plaster
ASTM E119 Fire Tests – Video
ASTM E84 Surface Burning Characteristics Test
Thermal Performance of Straw Bale Wall Systems (including Oak Ridge Lab test results) – N.Stone
Support Letters from Licensed Practitioners: Letters from 2 Structural Engineers, 4 Civil Engineers, 1 Professor of Civil Engineering, 7 Architects

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard proposed for inclusion in the code, [ASTM C141/C141M – 09, ASTM C1707-11, and EN 459-2010] with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2013.

RB473-13

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

APPENDIX R (NEW) #2-RB-HAMMER