BCAC Structural WG Items
October 2-3, 2018 Meeting

9-25-18 Notes:
Structural work group – 3:00 to 5:30 Eastern
Attending:
Staff – Kimberly Paarlberg
Committee:
Gary Ehrlich
Patrick Granson
Marc Nard

Interested Parties:
Jeff Feid
Jonathan Humble
John Taecker
Amanda Hickman
JP Cardin
Si Farvadin
Bob Davidson
Jose Roig
Larry

IBC 15-1 Applicability of SBCCI SSTD 11-97

1504.2 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.5.

1504.2.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.2.1.1 and 1504.2.1.2.

1504.2.1.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with Chapter 15 and either SBCCI SSTD 11 or ASTM C1568.

1504.2.1.2 Wind tunnel testing. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 and Chapter 15.

Reason:

Notes 9-25-2018: SBCCI SSTD 11 is no longer maintained. ASTM C1569 and ASTM C1570 and ASTM CC1568 may have spun off SBCCI SSTD 11. Tile roofing institute and Florida tile roof association should be contacted. John Taecker will investigate. No proposal at this time.

IBC 23-1 Clarification of lumber shrinkage

Revise as follows:

2303.7 Shrinkage effects. Where lumber is fabricated in a green condition, the design shall consider ~~consideration shall be given in design to the possible~~ the vertical effect of shrinkage due to cross-grain dimensional changes ~~considered vertically which may occur in lumber fabricated in a green condition~~.

Reason: Correct poorly worded requirement.

Cost Impact: None. This is editorial only.

9-25-2018: Check with Jim Smith

IBC 15-2/IRC 9-1 Reference to manufacturer's installation instructions

9-25-2018: John Taecker in process. Will talk with Mike Fischer. Not ready for Oct. meeting.

IRC 6-1 Notching and boring classifications

R602.6 Drilling and notching of studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. ~~Any~~ A stud in an exterior wall or bearing partition shall not be ~~permitted to be~~ cut or notched to a depth ~~not~~ exceeding 25 percent of its depth ~~width~~. Studs in nonbearing partitions shall not be ~~permitted to be~~ notched to a depth ~~not to exceed~~ exceeding 40 percent of a single stud depth ~~width~~.

2. Boring. ~~Drilling~~. ~~Any stud shall be permitted to be bored or drilled, provided that the diameter of the resulting hole is not more than~~ The diameter of bored holes in studs shall not exceed 60 percent of the stud depth ~~width~~, the edge of the hole shall be ~~is~~ not ~~more~~ less than 5/8 inch (16 mm) ~~to~~ from the edge of the stud, and the hole ~~is~~ shall not located in the same section as a cut or notch. Where the diameter of a bored hole in a stud located in exterior walls or bearing partitions ~~drilled~~ is over 40 percent, ~~and up to 60 percent~~ such stud shall be doubled ~~with~~ and not more than two successive doubled studs shall be so bored. See Figures R602.6(1) and R602.6(2).

> **Exception:** ~~Use of~~ Where approved stud shoes ~~is permitted where they~~ are installed in accordance with the manufacturer's ~~recommendations~~ instructions.

IRC R602.6 (2) Drilling. Any stud shall be permitted to be bored or drilled, provided that the diameter of the resulting hole is not more than 60 percent of the stud depth ~~width~~, the edge of the hole is not ~~more~~ less than 5/8 inch (16 mm) ~~to~~ from the edge of the stud, and the hole is not located in the same section as a cut or notch.

Reason: IMC 302.3.3, IPC C101.3, IFGC 302.3.4 sections were changed in this manner last cycle. The current text uses the word width, when actually it is the depth that is meant. The depth of a stud is the plane in which a hole is bored. Holes are not bored in the width (1 ½ inches) of a stud. This revision also gets rid of unenforceable permissive language. The current text says that any stud is permitted to be notched to a depth not exceeding 25%. This is stating a permitted limit; not a mandatory limit. A highway speed limit is not permitted to be 55 miles per hour, rather it is an absolute limit of 55. If the stud is permitted to be notched to not exceed 25%, then it also permitted to be notched to not exceed other percentages. Lastly, this proposal corrects a flaw where the text said that the edge of the hole cannot be more than 5/8 inch to the edge of the stud. The intent is exactly the opposite. The edge of the hole must not be less than 5/8 inch to the edge of the stud.

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

Notes 9-25-2018: Move forward, check for number of code change to add to reason statement.

IRC 9-1 Ice Shield clarifications (Chuck Bajnai)

Ice barrier is required in numerous places in Chapter 9 of the IRC –

Would it be required on the perimeter edge of a porch? (Shed roof or gable roof)

Would it be required on the perimeter edge of a screen porch?

Would it be required on the perimeter edge of an attached garage that does not have habitable space above?

I think this section is very misleading, and if I were not retiring in 2018, I would rewrite the sections to add clarity to the application.

I would like to offer the following code change proposal:

R905.17.4 and others:

R905.17.4 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 not less than 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 not less than 24 inches (610 mm) inside the exterior wall line of the building.
Exception: Detached accessory structures that do not contain conditioned floor area.

"In areas where there has been a history…and extend from the lowest edges of all roof surfaces to a point not less than 24 inches inside the exterior wall lines of the building.

Exception 1: Ice ~~shield~~ barrier is not required on the roof of a porch or roof overhangs exceeding 36 inches. *(the actual length of 36" is academic to the argument and can be any length the BCAC thinks is justifiable).*

Exception 2: Ice ~~shield~~ barrier is not required on the roof of an attached garage which has no habitable attic above it.

Exception 3. Detached accessory structures that do not contain conditioned floor area, or a habitable attic above it.

As an alternative code change proposal:

R905.17.4

Delete all text and replace it with

Ice ~~shield~~ barrier and drip edge shall be installed when the roofing manufacturer's instructions require them.

Reason: Issue 1: Ice ~~shield~~ barrier is required at eaves adjacent to heated spaces because of freeze and thaw cycles.

Therefore where there is no heat transfer to cause melting, then ice shield would not serve any purpose.

Issue 2: The code says “from the lowest edges of all roof surfaces…” So if I had a roof extend from the house over an 8’ wide porch, then the ice shield would have to start at the lowest edge of the eave and carry all the way up to the house plus 24 inches (total of about 10’). Does that make sense from the physical reality of the problem.

In my humble opinion, it is not needed at the edges of porches, or attached garages without habitable space above.

Notes 9-25-1028: See also IBC Section 1507.1.2. Do not move forward without more complete information and proposals. Exception 1 needs a study for what distance should be – ASCE 7 talks about 5’ for ice dams. Also, this seems to be only for one type of room materials, not all types of shingles.

IRC 3-1 Guard clarifications

The Deck Code Coalition (DCC) finds itself in a black hole and looks for ICC guidance. There was overwhelming support from building officials at the Public Comment Hearings in Kansas City last fall with regards to RB211 – Deck Guards, but the voting members balked at the code proposal and voted it down. This leaves deck builders and building officials in a conundrum: To what design load do we design deck guards? This vacuum was created by vague language in Table R301.5. In order to meet the January, 2019 code change submittal deadline, we are soliciting your help in aiming several questions to the right ICC committee(s).

BASIC QUESTION FOR ICC: What should a deck builder provide the building official to substantiate that a guard system passes IRC code?

Note: We are discussing guards and NOT handrails.

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 and handrails[d]	200[h]
Guard in-fill components[f]	50[h]
Passenger vehicle garages[a]	50[a]
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40[c]

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm², 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 clear height between joists and rafters is not more 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.

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 R507.1 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.

(continued)

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

g. Uninhabitable attics with limited storage are those where the 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 accessed 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 not less than 30 inches.
2. The slopes of the joists or truss bottom chords are not 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 pounds per square foot.

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.

To get a clearer understanding of the question, I will rewrite the question with several smaller questions.

- How is a building official to interpret the 200# requirement?
- Should the building official expect the deck guard system to pass a 200# test, a 400# test or a 500# test.
- How is the "200# applied in any direction" to be verified?

Point 1: Deck builders and building officials uncertain

For too many years, without evidence of compliance, most building officials have allowed just about any deck guard pass muster, and the deck builders have done nothing to stop them.

The rejection of ICC code change proposal RB211-2018 by the voting membership said they preferred no help as to too much help, i.e. decks are safe enough the way they are build today. This declaration offers no guidance for conscientious building officials and inspectors as to whether a constructed deck guard complies with Table R301.5 or not. Short of the deck builder testing every deck to some undefined testing method and undefined factor of safety in every direction, there is nothing prescriptive in the IRC which can substantiate compliance to the building official.

Point 2: Table R301.5 is too vague

Table R301.5 appears to be a homeowner's way of describing the intended loading condition – not necessarily the way an engineer might describe the loading condition; see footnote h for comparisons where the factor of safety is clearly stated.

So the problem with Table R301.5 is how the 200# is to be interpretted? The Loferski, Albright and Woeste paper (see attachment) called the 200# load as the "code required design load". Others call it a "working load", or an "actual load". Did the authors of Table R301.5 intend the 200# to be THE actual, working, verifiable load or did they intend something else?

Point 3: Testing

The purpose of the IRC is to provide affordable, time-tested, prescriptive, design standards to ensure safety for all users. In the case of deck guards, the language says "200# applied in any direction". It does not say "assume ASD", or assume LRFD". There are no prescriptive details in the code which have proved to be code compliant, i.e. you cannot use the eyeball test to determine if it is code compliant.

On the other hand, the IBC, Chapter 17 offers three methods of determining compliance:

1. through design
2. in-situ testing

   1709.3.2 says in-situ load testing: "…test load shall be equal to two times the ***unfactored*** design load. The test load shall be left in place for a period of 24 hours."

3. lab testing

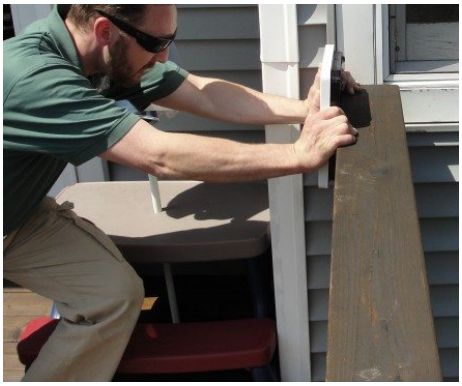
   1710.3.1 says preconstruction load testing: "The allowable superimposed design load shall be taken as the lesser of

1. The load at the deflection limitation…

2. The failure load divided by 2.5.

3. The maximum load applied divided by 2.5.

But assuming for a moment that a factor of safety would be universally accepted, there are no ASTM standards for how to test wood guards. All of the existing ASTM standards deal with steel or plastic wood guard systems – and those only test in the outward and downward directions.



Carrying that thought forward, building officials and deck builders are looking for guidance. If deck builders have to test each deck with in-situ test, what is the standard which they have to prove:

200# - built in the field

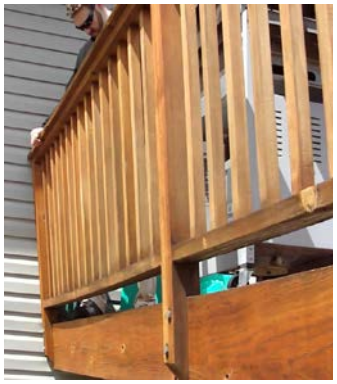
400# - built in the field

500# - built in the field.

To get the deck builder and building official out of this conundrum, how does he show compliance to the building official:

- In-situ testing by the deck builder or 3rd party testing agency? Expensive, time consuming
- Prescriptive details in the IRC? The ICC membership voted down details in RB211-2018.
- Ignore the problem? Been doing this forever.
- Rewrite the requirement in Table R301.5? ICC committee turned that idea down,
- Use existing test results to create new prescriptive details?
- Do they in fact have to test in the field for 24 hours? Is that 24 hours in each direction? Even the lab testing protocol only make them test in outward and downward directions.

Recognizing that the IRC is based on historical performance, can you give an opinion on the pictured detail. According to the Loferski, Albright and Woeste paper, this guard system was capable of resisting 237# of outward load in the lab- no testing was done on downward load. This method has been used for years around the country and accepted as meeting the 200# code requirement by building officials. It is comprised of (2) ½" diameter thru bolts with washers into a 2x8 band board.



Point 4: Safety

The deck failures we have seen and read about in the news are based on two problems:

- Attachment of the deck to the house
- Improper maintenance.

There is very limited evidence that deck failures occur at the guard system. Therefore we need to come up with something more logical than 400# or 500# test in all directions. It's great that ASCE-7 has had this criteria for several decades now, but it appears to be an expensive, and overly protective, not justifiable burden on all deck builders. ICC membership has clearly told us that they don't want to require the deck builders to pony up with the details the DCC developed or the proprietary details that some hardware companies are proposing as "best practices".

Point 5: Cost

There is another underlying factor that plays a major role in this whole discussion – cost: extra time and materials, extra hardware, extra testing. Professional deck builders have already given us feedback as to what they think about cost of our proposed details in RB211 – not to mention how they would react if we now required testing in-situ of each deck. How are the thousands of weekend warriors who build their own decks going to construct and test their decks?

Conclusion

Let's consider a continuum for where deck guard strength may lie:

0# _____200#_____500#

Membership wants

- Inexpensive
- Easy to build
- Passes eyeball test

ICC Code Committee wants

- Complies with IBC, ASCE-7
- Verifiable

The DCC tried two approaches for the 2018 IRC.

1. We proposed lowering the requirements in Table R301.5 to 200# outward and downward and 50# upward and inward. Proposal failed because the committee and engineers thought the standards in IBC and ASCE-7 were long standing and appropriate.
2. The DCC proposed 5 prescriptive details which passed the engineering design methodology but ICC membership turned them down because they were too expensive, burdensome and perceived as overly conservative.

The DCC is interested in getting your opinion and direction so we can draft language and details which offer the building officials, plan reviewers, inspectors, contractors and deck builders a way to visually determine compliance at whatever load we all can agree on.

Thank you, Chuck Bajnai, Chairman of the Deck Code Coalition

Notes 9-25-2018: Consideration of two proposals that will work together.

The proposal here is about direction of load applied, and applied to which element (top rail of guard or handrail). Study on guards showed that load application is an issue. How can this be built with normal construction? Gary is working with ASCE 7 on new deck loading criteria – early November maybe.

See supplement document – See IRC3-1 revised 9-12-2018

Supplement document is basically coordination of terminology which could work towards understanding of application of loads. Move ahead with terminology at least.

Add supplement document here.

IRC 3-1 Guard clarifications revised 9-12-2018

BCAC Proposal Structural work group – 2018 IBC revised 9-12-2018
Subject: Glass handrails, balusters, infill panels and guards
IRC and IBC Structural

Reason: The BCAC started a clean up of this language last round, but a couple of items are still not consistent.

The intent is to update section on glass panels when used as part of a handrail or guard (2407), impact locations (2406), and loading (1607) to coordinate with the language in Chapter 10 for handrails and guards, and to provide consistent terminology throughout the section.

The following is an explanation of the terminology as defined and when used correctly–

- A **handrail** is a rail that is between 34" ad 38" above a walking surface, stairway run or ramp run (1014). Handrails are required along stairways and ramps. Handrail is defined as **HANDRAIL.** A horizontal or sloping rail intended for grasping by the hand for guidance or support.
- A **guard** is the vertical element that prevents falls and is required where there is a drop off of 30" or more (1015). The minimum height for guards is 42", with lower guard heights permitted in assembly seating where there are line-of-site issues. A top rail of a guard can only serve as a handrail in assembly seating – Section 1029.15 Exception 2. Guard is defined as **GUARD.** A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.
- A **guardrail** is typically understood as the top rail of a guard. Since this used to be a term for a handrail on top of a guard (which had been permitted on stairways by the legacy codes) probably top rails of a guard is a better term. When 'guard' is in the list it would include the top rail of the guard as part of the system.
- **Barriers** are typically understood as short walls or railings that are not required guards.

There are several issues with the current text –

- The handrails are not glass – typically it is the in-fill component supporting the handrail. This should be clarified.
- The term 'guardrail" was changed last cycle to "top rail of guard" exception in the exception to Section 2407.1.
- There are intermediate landing at ramps and stairways – current language is only for landings on stairways (2406.4.6).
- The text currently uses multiple terms to describe the elements under the handrail or top rail of the guard – railing in-fill panels, balusters, railings, intermediate railings, structural baluster panels, nonstructural in-fill panels, guard in-fill components. Instead of multiple terms – use one term – this proposal picked in-fill components. It could be any of the above – just looking for consistency.
- Suggest reording the impact locations in IRC to put the guard/handrail provisions together.

1011, 1014 and 1015 -Currently, under stairways, only glass handrails are mentioned and not any supporting elements. Nothing for glass is referenced in ramps. It is more consistent to have the reference for glass in the handrail and guard sections.

IBC	IRC
SECTION 2406 **SAFETY GLAZING**	**SECTION R308** **GLAZING**
2406.4 Hazardous locations….	R308.4 Hazardous locations….
2406.4.4 Glazing in guards and ~~railings~~ where supporting handrails. Glazing in *guards* and ~~railings~~ where supporting handrails, including structural ~~baluster~~ ~~panels~~ and nonstructural in-fill components ~~panels~~, regardless of area or height above a walking surface shall be considered to be a hazardous location.	R308.4.4 Glazing in guards and ~~railings~~ where supporting handrails. Glazing in *guards* and ~~railings~~ where supporting handrails, including structural ~~baluster~~ ~~panels~~ and nonstructural in-fill fill components ~~panels~~, regardless of area or height above a walking surface shall be considered to be a hazardous location.
	~~R308.4.7~~ ~~R308.4.5~~ Glazing and wet surfaces….
2406.4.6 Glazing adjacent to stairways and ramps. Glazing where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface of stairways, ~~landings between flights of stairs and~~ ramps and landings between flights of	~~R308.4.5~~ ~~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) above the plane of the adjacent walking surface of stairways,

stairways and ramp runs shall be considered to be a hazardous location. **Exceptions:** 1. The side of a stairway, ~~landing or~~ ramp or landing that has a guard complying with the provisions of Sections 1015 and 1607.8, and the plane of the glass is greater than 18 inches (457 mm) from the ~~railing~~ guard. 2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.	~~landings between flights of stairs and~~ ramps and landings between flights of stairways and ramp runs shall be considered to be a hazardous location. **Exceptions:** 1. Where glazing is adjacent to a walking surface and a horizontal rail is installed at 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 have a cross-sectional height of not less than 1-1/2 inches (38 mm). 2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.
2406.4.7 Glazing adjacent to the bottom stairway landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 60 inches (1524 mm) above the landing and within a 60-inch (1524 mm) horizontal arc that is less than 180 degrees (3.14 rad) from the bottom tread nosing shall be considered to be a hazardous location. **Exception:** Glazing that is protected by a guard complying with Sections 1015 and 1607.8 where the plane of the glass is greater than 18 inches (457 mm) from the guard.	**R308.4.6 ~~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 (1524 mm) horizontal arc less than 180 degrees (3.14 rad) from the bottom tread nosing shall be considered to be a hazardous location. (See Figure R308.4.7.) **Exception:** Where 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*.
SECTION 2407 **GLASS IN HANDRAILS AND GUARDS**	
2407.1 Materials. ~~Glass~~ Glazing used ~~in~~ to support a handrail or in a *guard* shall be laminated glass constructed of fully tempered or heat strengthened glass and shall comply with Category II or CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1. Glazing in ~~railing~~ in-fill components ~~panels~~ shall be of an *approved* safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be 1/4 inch (6.4 mm). **Exception:** Single fully tempered glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1 shall be permitted to be used ~~in~~ to support handrails and ~~guardrails~~ in guards where there is no walking surface beneath them or the walking surface is permanently protected from the risk of falling glass.	**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 II unless otherwise 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 unless otherwise indicated in Table R308.3.1(2).

2407.1.1 Loads. The in-fill components ~~panels~~ and their support system shall be designed to withstand the loads specified in Section 1607.8. Glass guard elements shall be designed using a factor of safety of four.	
2407.1.2 Structural glass ~~baluster~~ in-fill components ~~panels~~**.** Guards with structural glass ~~baluster~~ in-fill components ~~panels~~ shall be installed with an attached top rail or handrail. The top rail or handrail shall be supported by not fewer than three glass ~~baluster~~ in-fill components ~~panels~~, or shall be otherwise supported to remain in place should one glass ~~baluster~~ in-fill components ~~panels~~ fail. **Exception:** An attached top rail or handrail is not required where the glass ~~baluster~~ in-fill components ~~panels~~ are laminated glass with two or more glass plies of equal thickness and of the same glass type. The in-fill components ~~panels~~ shall be tested to remain in place as a barrier following impact or glass breakage in accordance with ASTM E2353.	R308.4.4.1 Structural glass ~~baluster~~ in-fill components ~~panels~~. Guards with structural glass ~~baluster~~ in-fill components ~~panels~~ shall be installed with an attached top rail or handrail. The top rail or handrail shall be supported by not less than three glass ~~baluster~~ in-fill components ~~panels~~, or shall be otherwise supported to remain in place should one glass ~~baluster~~ in-fill components ~~panels~~ fail. Exception: An attached top rail or handrail is not required where the glass ~~baluster~~ in-fill components ~~panels~~ are laminated glass with two or more glass plies of equal thickness and of the same glass type.
2407.1.3 Parking garages. Glazing materials shall not be installed in handrails or *guards* in parking garages except for pedestrian areas not exposed to impact from vehicles.	
2407.1.4 Glazing in windborne debris regions. Glazing installed ~~in~~ as in-fill components ~~panels or balusters~~ in *windborne debris regions* shall comply with the following:	
2407.1.4.1 ~~Balusters and~~ Glazing in in-fill components ~~panels~~**.** ~~Glass~~ Glazing installed in exterior guards ~~railing~~ or in-fill panels ~~or balusters~~ shall be laminated glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.	
2407.1.4.2 Glass supporting top rail. Where the top rail of a guard is supported by glass, the assembly shall be tested according to the impact requirements of Section 1609.2. The top rail of a guard shall remain in place after impact.	
SECTION 1607 LIVE LOADS	**R301.5 Live load.** The minimum uniformly distributed live load shall be as provided in Table R301.5.
1607.8 Loads on handrails, guards, grab bars and	**TABLE R301.5**

seats. Handrails and *guards* shall be designed and constructed for the structural loading conditions set forth in Section 1607.8.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607.8.2. **1607.8.1 Handrails and guards.** *Handrails* and the top rails of *guards* shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1 of ASCE 7. Glass handrails ~~assemblies~~ and the top rails of *guards* shall also comply with Section 2407. **Exceptions:** 1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.8.1.1 shall be applied. 2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an *occupant load* less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).	**MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS** **(in pounds per square foot)** Guards and Handrails[d] 200 [h] Guard in-fill components[f] 50[h] d. A single concentrated load applied in any direction at any point along the top. f. Guard in-fill components (all those except the handrail or top rail of a *guard*), ~~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. h. Glazing used in supporting 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 handrail or the top rail of the guard, 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.
1607.8.1.1 Concentrated load. Handrails and the top rail of guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.	
1607.8.1.2 Intermediate rails, and infill components. Intermediate rails (all those except the *handrail* or top rail of a *guard*), ~~balusters~~ and in-fill components ~~panels fillers~~ shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1 of ASCE 7.	
Section 1011 **Stairways**	R311.7 Stairways. R311.8 Ramps.
1011.11 Handrails. *Flights of stairways* shall have *handrails* on each side and shall comply with Section 1014. Where glass is used to ~~provide~~ support the *handrail*, the *handrail* shall comply with Section 2407. **Exceptions:** 1. *Flights of stairways* within dwelling units and *flights of spiral stairways* are permitted to have a *handrail* on one side only. 2. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a	

landing do not require *handrails*. 3. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require *handrails*. 4. Changes in room elevations of three or fewer risers within dwelling units and sleeping units in Group R-2 and R-3 do not require *handrails*.	
SECTION 1014 **HANDRAILS**	
1014.1 Where required. *Handrails* serving *flights of stairways*, *ramps*, stepped *aisles* and ramped *aisles* shall be adequate in strength and attachment in accordance with Section 1607.8. *Handrails* required for *flights of stairways* by Section 1011.11 shall comply with Sections 1014.2 through 1014.9. *Handrails* required for *ramps* by Section 1012.8 shall comply with Sections 1014.2 through 1014.8. *Handrails* for stepped *aisles* and ramped *aisles* required by Section 1029.16 shall comply with Sections 1014.2 through 1014.8.	**R311.7.8 Handrails.** Handrails shall be provided on not less than one side of each flight of stairs with four or more risers. **R311.8.3 Handrails required.** Handrails shall be provided on not less than one side of ramps exceeding a slope of one unit vertical in 12 units horizontal (8.33-percent slope).
1014.1.1 Glazing. Where glazing is used to support a *handrail*, the *handrail* and in-fill components shall comply with Section 2407.	**R3111.7.8.1 Loading.** Handrails shall be adequate in strength and attachment in accordance with Section R301.5. Where glazing is use to support a handrail, the in-fill components shall comply with R308.4.4 through R308.4.6. **R3111.8.3.1 Loading.** Handrails shall be adequate in strength and attachment in accordance with Section R301.5. Where glazing is use to support a handrail, the in-fill components shall comply with R308.4.4 and R308.4.5. *(References reflect new numbers for these sections)*
SECTION 1015 **GUARDS**	**R312.1 Guards.** *Guards* shall be provided in accordance with Sections R312.1.1 through R312.1.4.
1015.2.1 Glazing. Where ~~glass~~ glazing is used to provide a *guard* or as a portion of the *guard* system, the *guard* shall comply with Section 2407. Where the glazing provided does not meet the strength and attachment requirements of Section 1607.8, complying *guards* shall be located along glazed sides of open-sided walking surfaces.	**R312.1.1 Where required.** *Guards* shall be provided for those portions of 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*.

IBC 17-1 Special inspections structural wood windforce-resisting system (Gary Ehrlich)

<Introduction> During a Structural WG call for the TWB, it was noted there were questions about changes the TWB had proposed to Section 1705.11.1 and 1705.12.2 (below) modifying the long-standing exceptions from special inspections. Specifically, how the change was specific to CLT and mass timber, versus possibly having an impact on non-mass-timber products.

I suggested taking the proposed language to BCAC for consideration as a Group B item. I also offered to champion it both as a BCAC member and possible (if not probable) chair of the BCAC Structural TG.

Section 1705.11.1 Structural Wood

Revise as follows:
1705.11.1 Structural wood. *Continuous special inspection* is required during field gluing operations of elements of the main windforce-resisting system. *Periodic special inspection* is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

> **Exception:** *Special inspections* are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the main windforce-resisting system, where the lateral resistance is provided by structural sheathing and the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.

Section 1705.12.2 Structural Wood

Revise as follows:
1705.12.2 Structural wood. For the seismic force-resisting systems of structures assigned to *Seismic Design Category* C, D, E or F:

1. *Continuous special inspection* shall be required during field gluing operations of elements of the seismic force-resisting system.

2. *Periodic special inspection* shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

> **Exception:** *Special inspections* are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the seismic force-resisting system, where the lateral resistance is provided by structural sheathing and the fastener spacing of the sheathing is more than 4 inches (102 mm) on center.

Notes 9-25-2018: Need reason and cost statement. Gary will work with Tall Wood Building group.

SPRI's (Amada Hickman) 2019 - Group B Proposal Concepts
For BCAC's Review and Comment
(March 13-14, 2018 Face-to Face meeting)

IBC 15-3 – Coping

Revise language as follows:

1503.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

Exception: Roofing system assemblies where the roof covering membrane is installed to extend and wrap over parapet walls at the perimeter that are less than 30 inches (762 mm) and down to the exterior side of the wall.

Sept 11, 2018 meeting notes
Alternative language (Amanda and Mike)
1503.3 ~~Parapet walls~~ Coping. Other than at fire walls, Parapet walls shall be properly coped with ~~noncombustible~~, weatherproof materials of a width not less than the thickness of the parapet wall. Fire walls, where they extend through the roof, shall be properly coped with non-combustible, weatherproof materials of a width not less than the thickness of the parapet wall.

Reason:

Section 705.11.1 of the IBC for Parapet Construction, requires that parapet walls be not less than 30 inches. This proposal only applies to parapet walls at the perimeter that are less than 30 inches. This language will allow a greater variety of options for waterproofing the parapet wall. This will also provide additional options for maintaining a continuous air barrier. For example, the roof membrane could be used to wrap the top of the parapet wall and extend down the exterior side of the wall. The membrane could then be tied into the wall air barrier system.

Cost Impact:

The code change proposal will not increase or decrease the cost of construction.

No additional materials or detailing will be required based on this code change proposal; therefore it will not increase the cost of construction.

Notes 9-25-2018: This was discusses at previous meetings. Follow 2nd option (highlighted). Removal of 'noncombustible' is a concern if this was applied to a fire wall that extended through a roof. Not a concern for parapet walls at perimeter. Parapet is defined under 'wall.' Amanda will work on revised reason.

IBC 15-4 – Edge Securement

Revise language as follows:

1504.5 Edge securement for low-slope roofs. Metal edge systems, except gutters, installed on low-slope built-up, modified bitumen and single-ply roof systems, ~~metal edge securement, except gutters,~~ shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design wind speed, V, shall be determined from Figures 1609.3(1) through 1609.3(8) as applicable.

Reason: This proposal is intended to clarify that regardless if the roof membrane is either independently or dependently terminated, the edge metal system needs to be properly tested to the appropriate standard. Metal edge systems prevent water infiltration, and in many cases to also secure the roof membrane. Loss of the edge system or components of the edge system during a high wind event could allow for water infiltration even if the roof membrane remains secure. Furthermore, any component of the edge system that becomes disengaged during a high wind event will become a projectile that can damage the roof membrane and other building components (windows, doors, walls, etc.), and possibly injure people. Therefore, metal edge systems should be tested per ES-1 whether they secure the membrane or not.

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

This proposal just clarifies that this test applies to edge metal regardless of installation method.

Notes 9-25-2018: move ahead

IBC 15-5 – Gutter Securement

Add new language as follows:

1504.5.1 Gutter securement for low-slope roofs. External gutters installed on low-slope (less than 2:12 slope) built-up, modified bitumen, and single ply roofs, shall be designed and constructed to resist wind loads as required by Chapter 16 and tested ~~for resistance~~ in accordance with Test Methods G-1 and G-2 of ANSI/SPRI GT-1.

Reason: Currently the IBC requires that low-slope built-up, modified bitumen, and single-ply roof system metal edge securement be tested to resist wind and static loads, but specifically excludes gutters that are used to secure these roof systems in many cases. Studies of the aftermath of high-wind events revealed that many gutter systems did not resist the loads that occur during these high-wind events. Examples of these observations are shown below. SPRI developed the gutter test standard to address this issue. The wind resistance tests included in this standard measure the resistance of the gutter system to wind forces acting outwardly (away from the building) and to wind forces acting upwardly tending to lift the gutter off of the building. The standard also measures the resistance of the gutter system to static forces of water, snow and ice acting downward. Following are examples of gutter failures during high wind events observed during investigations conducted by the Roofing Industry Committee on Weather Issues (RICOWI).

Cost Impact:

The code change proposal will not increase or decrease the cost of construction.

A cost comparison was done between a gutter system that would and would not resist design wind loads. There was no difference in the cost of the two systems.

Notes 9-25-2018: Difficult for site installed gutters to meet. More specific reference in Chapter 16. What defines a low sloped roof. (2:12 or less)? G-1 and G-2 of ANSI/SPRI GT-1 standard exempts gutters and downspouts. Amanda will check. Maybe just for high wind regions? What is the standard spacing of brackets that will work? Amanda will revise.

IBC 15-6 – Chapter 15 reorganization

(Originally introduced in Group A – John Taecker and Bruce Johnson)

Notes 9-25-2018: No proposal at this time. John and Bruce working on this. Nothing for Oct. meeting.

IBC 23-2 – TWB issues

Chapter 23 Code WG Input: DRAFT – 22AUG17 – V1

[Includes notes taken during 2/16/18 Structural WG meeting.]

2302 Add reference to new mass (MT) timber definition in Section 202. Editorial

[2/16/18: Mass Timber definition: covered in Ch 2. Italicized definitions. No further action.]

2303.1.4 Monitor changes to existing CLT product standard, PRG 320:

- Add requirement for sealant at CLT connections in 2303.1.4 or in Ch 7? Fire WG?
- Consider option to create a requirement for heat delamination resistant (HDR) adhesive for exposed CLT in Type IV B and C (similar to heat resistant adhesive (HRA) in 2303.1.1.2)? Fire WG?

[2/16/18: Update to PRG-320 covered adhesives. Codes WG covered sealant. No further action.]

2304.3.3 Shrinkage: update language to include mass timber platform framing systems. Is there a height limit on platform framing? Structural WG?

[2/16/18: AWC to provide recommendation.]

2304.9.3 Update mechanically laminated decks to incorporate latest thinking on NLT and/or DLT... Correlate with definitions. See S276-16 and S281-16 nailing required for NLT and reference of 2304.9 to Heavy Timber in the 2018 IBC. Need to consider

updating toenail to bearing requirement to allow prefab NLT and DLT panel erection? Structural WG?

[2/16/18: Not a tall timber issue, but more likely a code proposal AWC would submit to Group B process. Lucas Epp and Tanya Luthi available to discuss with Brad Douglas to generate potential code proposal.]

2304.11 Establish equivalent thickness of SCL MT panel products for use as a heavy timber panel product? (SCL minimum dimensions are already provided for columns and beams in the 2015 IBC)? Fire WG?

[2/16/18: AWC to address in code if SCL panels become mainstream.]

2304.11 See G179-15 and G180-15 reorganization in 2018 IBC. Once changes are published, need to update and correlate 2021 IBC proposed changes to be consistent with new definitions of mass timber and heavy timber (heavy timber a subset of mass timber with no change in substance). Also note G184-15 change in 2018 IBC to clarify thickness of Type IV HT exterior walls. To be published by ICC… pending.

[2/16/18: Keep as action item. Correlations pending approval of Group A proposals. AWC to assist Structural WG.]

2304.12.2.4 Update to include CLT? CLT is currently available in naturally durable wood. Structural WG?

[2/16/18: Not a tall wood issue. Product standard, PRG 320, limits use of CLT to dry service condition use. NDS does not permit CLT in exterior applications wet service conditions either. Recommendation for BCAC to review the prohibition of CLT panels in exterior conditions since the product standard PRG 320 might not be prominent enough to provide direction to architects and building officials.]

2304.13 Update with research on composite concrete toppings on CLT or NLT? Structural WG?

[2/16/18: Not a TWB issue, recommendation for BCAC. AWC says at this time there is no plan to incorporate composite concrete toppings on CLT or NLT panels into next revision of NDS.]

2305 through 2307 Possible updates needed either here or in other parts of the IBC to coordinate with AWC Special Design Provisions for Wind and Seismic for mass timber diaphragms and/or for ASCE 7 LRFD fire design. There is currently a white paper and testing on mass timber diaphragms and ongoing research. Structural WG?

[2/16/18: Not a TWB issue, recommendation for AWC to incorporate into NDS via already formed task group when supporting research becomes available.]

Notes 9-25-2018: No proposals at this time. Interested stakeholders with the expertise should work on this together.

IBC 15-7 (S22-16) Roof Aggregate – NIST

Notes 9-25-2018: No proposal at this time. Investigations from Joplin tornado was brought forward last cycle – Risk category 3 and 4. Did not pass last cycle.

IBC 19-1 – Re-bar specifications

(Introduced at 9.11.2018 WG call)

Revise as follows:

1901.5 Construction documents. The *construction documents* for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors. See Table 1901.5 for reinforcement bar sizes.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to *Seismic Design Category* D, E or F, a statement if slab on grade is designed as a structural diaphragm.

TABLE 1901.5 REINFORCEMENT BAR SIZES

NUMBER	NOMINAL DIAMETER (inches)	NOMINAL AREA (square inches)	NOMINAL WEIGHT (pounds/foot)
3	0.375	0.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.60	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.65
18	2.257	4.00	13.60

For SI: 1 inch = 25.4 mm; 1 square inch = 645.16 mm^2; 1 pound/foot = 1.488 kg/m

Reason: This is an editorial change to bring useful information into the code. This information can be used by all types of code users to understand and verify re-bar size requirements consistent with industry sizing. The sizing information shown is consistent with ACI 318 and ASTM A615.

Cost Impact: This proposal will neither increase nor decrease the cost of construction as it is editorial in nature.

Notes 9-25-2018: This information is already in Concrete Institute publications. Rebar is embossed with the number, so no need to have dimensions. Do not move forward.

New 9-18-2018

2018 Group B BCAC Structural WG

Proposal #

1604.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604.5.Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604.5 shall be used in lieu of ASCE 7, Table 1.5-1.

TABLE 1604.5

RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities f or potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b]

IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated emergency shelters including earthquake~~, hurricane or other emergency~~ shelters and community storm shelters where intended for short-term recovery use after a natural disaster event. Stand alone community storm shelters. Designated *community storm shelters* that are also intended for recovery use after a natural disaster event. • Designated emergency preparedness, communications and operations centers and other facilities required f or emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code;* and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.
b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: The purpose of this code change proposal is to clarify the intent of Table 1604.5 with respect to classifying emergency shelters as Risk Category IV and to correlate the provisions with Section 423, Storm Shelters. Code changes to 2018 IBC (G32, developed and co-sponsored by BCAC, FEMA and NIST) was approved (AMPC) to clarify that shelters built for protection during wind storms and in accordance with ICC500-14 are not emergency shelters that are required to be designed as Risk Category IV structures in accordance with Section 1604.5 unless they are also designated for emergency use after the storm. Without the proposed modification to the existing emergency shelter language in Table 1604.5, designers and code officials have no indication that the provisions in Section 423 exempt storm shelters from Risk Category IV requirements when constructed in accordance with ICC 500 and intended for use during the storm only.

Notes 9-25-2018: Need to be the difference between a shelter designated for general community use vs. a single room or a series of rooms within a business, school, - places not always open to the public. Language options are if Category IV should apply to after the storm emergency shelters (possibly any building in the community) or just the EMA designated shelters for the safety of the community. Should not apply

category IV for mixed use buildings that are for other purposes that also include tornado shelters.

[BG] STORM SHELTER. A building, structure or portions thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.
Community storm shelter. A storm shelter not defined as a “Residential storm shelter.”
Residential storm shelter. A storm shelter serving occupants of *dwelling units* and having an *occupant load* not exceeding 16 persons.