2007/2008 PROPOSED CHANGES TO THE INTERNATIONAL EXISTING BUILDING CODE

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TENTATIVE ORDER OF DISCUSSION

2007/2008 PROPOSED CHANGES TO THE INTERNATIONAL EXISTING BUILDING CODE

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.

EB1-07/08
EB2-07/08
EB3-07/08
    G6-07/08, Part IV
    G7-07/08, Part II
    G8-07/08, Part II
    G9-07/08, Part II
    G10-07/08, Part II
    G12-07/08, Part III
EB4-07/08
EB5-07/08
EB6-07/08
    FS5-07/08, Part II
    G207-07/08, Part II
    S55-07/08, Part II
EB7-07/08
EB8-07/08
EB9-07/08
    G209-07/08, Part II
EB10-07/08
EB11-07/08
EB12-07/08
EB13-07/08
EB14-07/08
EB15-07/08, Part I
EB16-07/08
EB17-07/08
EB18-07/08
    G214-07/08, Part II
    G213-07/08, Part II
    G215-07/08, Part II
EB19-07/08
EB20-07/08
EB21-07/08
EB22-07/08
EB23-07/08
EB24-07/08
EB25-07/08
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EB28-07/08
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EB30-07/08
EB31-07/08
EB32-07/08
EB33-07/08
EB34-07/08
EB35-07/08
    G211-07/08, Part II
EB36-07/08
EB37-07/08
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EB42-07/08
EB43-07/08
EB44-07/08
EB45-07/08
EB46-07/08
EB47-07/08
EB48-07/08
EB49-07/08
EB50-07/08
EB51-07/08

EB1–07/08
101.5, 506

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

1. Revise as follows:

101.5 (Supp) Compliance methods. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 101.5.1 through 101.5.3 as selected by the applicant. Application of a method shall be the sole basis for assessing the compliance of work performed under a single permit unless otherwise approved by the code official. Sections 101.5.1 through 101.5.3 shall not be applied in combination with each other. Where this code requires consideration of the seismic-force-resisting system of an existing building subject to repair, alteration, change of occupancy, addition or relocation of existing buildings, the seismic evaluation and design shall be based on Section 101.5.4 regardless of which compliance method is used.

> **Exception:** Subject to the approval of the code official, alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building is undergoing more than a limited structural alteration as defined in Section 807.5.3. New structural members added as part of the alteration shall comply with the *International Building Code*. Alterations of existing buildings in flood hazard areas shall comply with Section 601.3.

101.5.1 Prescriptive compliance method. Repairs, alterations, additions and changes of occupancy complying with Chapter 3 of this code in buildings complying with the *International Fire Code* shall be considered in compliance with the provisions of this code.

101.5.2 Work area compliance method. Repairs, alterations, additions, changes in occupancy and relocated buildings complying with the applicable requirements of Chapters 4 through 12 of this code shall be considered in compliance with the provisions of this code.

101.5.3 Performance compliance method. Repairs, alterations, additions, changes in occupancy and relocated buildings complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

2. Add new text as follows:

101.5.4 Seismic evaluation and design procedures. Where this code requires compliance with IBC or reduced IBC level seismic forces, the seismic evaluation and design of an existing building and its components shall comply with this section.

101.5.4.1 Compliance with IBC level seismic forces. Where compliance with the seismic design provisions of the *International Building Code* is required, the procedures used shall be in accordance with one of the following.

1. The *International Building Code* using one-hundred percent of the prescribed forces. The *R* factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R* factor specified for structural systems classified as “Ordinary” in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as “Intermediate” or “Special”.
2. Compliance with ASCE 41 using both the BSE-1 and BSE-2 Earthquake Hazard Levels and the corresponding performance levels shown in Table 101.5.4.1.

TABLE 101.5.4.1
PERFORMANCE CRITERIA FOR IBC LEVEL SEISMIC FORCES

OCCUPANCY CATEGORY (Based on IBC Table 1604.5)	PERFORMANCE LEVEL FOR USE WITH ASCE 31 AND WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL	PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-2 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Collapse Prevention (CP)
II	Life Safety (LS)	Collapse Prevention (CP)
III	Note a	Note a
IV	Immediate Occupancy (IO)	Life Safety (LS)

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

101.5.4.2 Compliance with reduced IBC level seismic forces. Where seismic evaluation and design is permitted to meet reduced *International Building Code* seismic force levels, the procedures used shall be in accordance with one of the following:

1. The *International Building Code* using seventy-five percent of the prescribed forces. The *R* factor used for analysis shall be as specified in Section 101.5.4.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.5 shall be deemed to comply with this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak, or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.
   - 2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all Occupancy Categories are permitted to be based on the procedures specified in Appendix Chapter A5.
3. Compliance with ASCE 31 based on the applicable performance level as shown in Table 101.5.4.2.
4. Compliance with ASCE 41 using the BSE-1 Earthquake Hazard Level and the performance level shown in Table 101.5.4.2. The design spectral response acceleration parameters S_{XS} and S_{X1} specified in ASCE 41 shall not be taken less than seventy-five percent of the respective design spectral response acceleration parameters S_{DS} and S_{D1} defined by the *International Building Code*.

TABLE 101.5.4.2
PERFORMANCE CRITERIA FOR REDUCED IBC LEVEL SEISMIC FORCES

OCCUPANCY CATEGORY (Based on IBC Table 1604.5)	PERFORMANCE LEVEL FOR USE WITH ASCE 31	PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Life Safety (LS)
II	Life Safety (LS)	Life Safety (LS)
III	Note a	Note a
IV	Immediate Occupancy (IO)	Immediate Occupancy (IO)

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

3. Delete the following text and relocate to Sections 101.5.4, 101.5.4.1, Table 101.5.4.1, 101.5.4.2, Table 101.5.4.2 as shown above):

~~SECTION 506~~
~~STRUCTURAL~~

~~**506.1 General.** Repairs of structural elements shall comply with this section.~~

~~**506.1.1 Seismic evaluation and design.** Seismic evaluation and design of an existing building and its components shall be based on the following criteria.~~

~~**506.1.1.1 Evaluation and design procedures.** The seismic evaluation and design shall be based on the procedures specified in the *International Building Code*, ASCE 31 or FEMA 356. The procedures contained in Appendix A of this code shall be permitted to be used as specified in Section 506.1.1.3.~~

~~**506.1.1.2 IBC level seismic forces.** When seismic forces are required to meet the *International Building Code* level, they shall be one of the following:~~

1. ~~One-hundred percent of the values in the *International Building Code*. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special."~~
2. ~~Those associated with the BSE-1 and BSE-2 Earthquake Hazard Levels defined in FEMA 356. Where FEMA 356 is used, the corresponding performance leve~~

~~TABLE 506.1.1.2~~
~~FEMA 356 AND ASCE 31 PERFORMANCE LEVELS~~

(Delete table in its entirety)

~~**506.1.1.3 Reduced IBC level seismic forces.** When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:~~

1. ~~Seventy-five percent of the forces prescribed in the *International Building Code*. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor as specified in Section 506.1.1.2 of this code.~~
2. ~~In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A shall be deemed to comply with the requirements for reduced *International Building Code* force levels.~~
   - ~~2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.~~
   - ~~2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.~~
   - ~~2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.~~
   - ~~2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.~~
   - ~~2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.~~
3. ~~In accordance with ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2.~~
4. ~~Those associated with the BSE-1 Earthquake Hazard Level defined in FEMA 356 and the performance level as shown in Table 506.1.1.2. Where FEMA 356 is used, the design spectral response acceleration parameters *SXS* and *SX1* shall not be taken less than 75 percent of the respective design spectral response acceleration parameters *SDS* and *SD1* defined by the *International Building Code* and its reference standards.~~

~~**506.1.2 Wind design.** Wind design of existing buildings shall be based on the procedures specified in the *International Building Code* or *International Residential Code* as applicable.~~

4. Revise and reorganize remaining Section 506 as follows:

~~506.2~~ <u>506.1</u> Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

~~**506.2.1 Dangerous conditions.** Regardless of the extent of structural damage, dangerous conditions shall be eliminated.~~

<u>**506.2.1 Repairs for less than substantial structural damage.** For damage less than substantial structural damage, the damaged elements shall be permitted to be restored to their pre-damage condition.</u>

506.2.2 <u>Repairs for</u> substantial structural damage to vertical elements of the lateral-force-resisting system. A building that has sustained substantial structural damage to the vertical elements of its lateral-force-resisting system shall be evaluated ~~and repaired~~ in accordance with ~~the applicable provisions of Sections~~ <u>Section</u> 506.2.2.1<u>, and either repaired in accordance with Section 506.2.2.2 or repaired and rehabilitated in accordance with Section 506.2.2.3 depending on the results of the evaluation</u> ~~through 506.2.2.3~~.

506.2.2.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamaged state, would comply with the provisions of the *International Building Code*~~. Wind forces for this evaluation shall be those prescribed in the *International Building Code*. Seismic forces for this evaluation are~~, except that the seismic design criteria shall be permitted to be the reduced level seismic forces specified in Section ~~506.1.1.3~~ 101.5.4.2.

506.2.2.2 Extent of repair for compliant buildings. If the evaluation establishes ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then the damaged elements shall be permitted to be restored to their pre-damage condition ~~repairs shall be permitted that restore the building to its predamaged state using materials and strengths that existed prior to the damage~~.

506.2.2.3 Extent of repair for noncompliant buildings. If the evaluation does not establish ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then the building shall be rehabilitated to comply with ~~applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces~~ the provisions of this section. The wind ~~design level~~ loads for the repair and rehabilitation shall be ~~as~~ those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the ~~design level shall be as required by the code in effect at the time of original construction or as required by~~ wind loads shall be in accordance with the *International Building Code*~~, whichever is greater~~. The seismic ~~forces~~ loads for this rehabilitation design shall be those required ~~for the design of the predamaged building~~ by the building code in effect at the tiem of original construction, but not less than the reduced level seismic forces specified in Section ~~506.1.1.3~~ 101.5.4.2. ~~Newstructural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

506.2.3 Substantial structural damage to ~~vertical~~ gravity load-carrying components. ~~Vertical~~ gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the *International Building Code*. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects Undamaged ~~vertical~~ gravity load-carrying components that receive dead, ~~or~~ live or snow loads from rehabilitated components shall also be rehabilitated ~~to carry~~ if required to comply with the design loads of the rehabilitation design. ~~New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

506.2.3.1 Lateral-force-resisting elements. Regardless of the level of damage to ~~vertical~~ gravity elements of the lateral force-resisting system, if substantial structural damage to vertical load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 506.2.2.1 and, if noncompliant, rehabilitated in accordance with Section 506.2.2.3.

~~**506.2.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its predamaged state using materials and strengths that existed prior to the damage. New structural members and connections used for this repair shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~**506.2.5**~~ **506.2.4 Flood hazard areas.** In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the *International Building Code*.

Reason: The proposed revisions serve the following three primary purposes.

1. Allows the alternate seismic evaluation and design procedures (ASCE 31, ASCE 41, and Appendix A) to be used for the Prescriptive and Performance methods as well as the Work Area method. Without the ability to use these alternates to the IBC, the Prescriptive and Performance methods are not well suited for structural work in many existing buildings.
2. Makes editorial clarifications to Section 506.1 and 506.2 to improve clarity, flow, and delete redundant and unnecessary text. These editorial revisions are summarized as follows:
    a. Makes editorial clarifications to the seismic evaluation and design provisions in Sections 506.1.1.2 and 506.1.1.3. Intent is to focus on design criteria, compliance, and loads, rather than on forces.
    b. Splits Table 506.1.1.2 into two tables, one for full IBC forces and one for reduced IBC forces for added clarity.
    c. Clarifies difference between repair (fixing damage) and rehabilitation (additional upgrades triggered by the extent of repair and conformance of the existing building) for added clarity.
    d. Moves the text of current Section 506.2.1 to Section 506.1 for improved scoping and to ensure that requirement applies to all repairs.
    e. In Section 506.2 the requirements for less than substantial damage are moved before those for substantial damage for improved usability.

f. Deletes section 506.1.2, which is redundant. Wind design criteria is adequately referenced in various subsections of Section 506.2 for repairs. Other Work Area method chapters provide adequate reference to the IBC for wind loads that this section is not necessary.

3. Makes two substantive revisions to 506.2:
   a. 506.2.2.3: requires rehabilitation to IBC wind loads, instead of the greater of the IBC and the code under which the original design was done.
   b. 506.2.3: includes evaluation of snow load criteria if the damage was caused by snow.

Based on the current seismic requirements in the Prescriptive and Performance Compliance methods, it is possible that these methods cannot be used for many older existing buildings. IEBC Section 302.2.3 requires that where additions or alterations result in more than a 10 percent increase in seismic demand or 10 percent decrease in seismic capacity, the entire seismic-force-resisting system be shown or rehabilitated to conform to the seismic requirements for new buildings in accordance with ASCE 7. IEBC Section 1301.4.1 requires that the existing building be capable of supporting the minimum load of IBC Chapter 16. For seismic design, the strength, stiffness, and detailing cannot be separated since the seismic loads are based on an R-factor, which depends on system detailing. These detailing requirements are often not satisfied in older buildings and it is usually impractical to revise the detailing in order to comply with the current seismic codes. Therefore, the IBC is often not well suited for seismic evaluation and rehabilitation of existing buildings. If it is not practical or possible to demonstrate IBC compliance in an existing building, then the Prescriptive and Performance Compliance methods may not be able to be used, since IEBC Section 101.5 prohibits mixing and matching of compliance methods.

It seems contrary to the stated intent of the IEBC (Section 101.3) that seismic requirements would not allow two of the three compliance methods in the code to be used for some buildings. Therefore, this proposal revises the IEBC to allow the alternative seismic evaluation and design standards and guidelines current referenced in Chapter 5 for the Work Area method (ASCE 31, ASCE 41, and Appendix A) to be used for all three compliance methods. Based on the scoping language and limitations in Section 506.2, any of the three sets of provisions can be used for buildings where the Work Area Method is being proposed, and there is no good reason why these provisions should not be permitted for the Prescriptive and Performance Compliance methods.

All three sets of provisions were specifically developed for existing buildings and provide seismic evaluation and design criteria results in seismic performance that is fairly uniform. The proposed scoping is such that where either Chapter 3 or Chapter 13 requires compliance with the IBC, the provisions for “full IBC level forces” (new Section 101.5.4.1 is used). Where reduced IBC forces are permitted, then new Section 101.5.4.2 will apply, which based on the current text of Chapters 3 and 13, will not apply to either methods, so this proposal will not reduce the required seismic performance criteria for Chapters 3 and 13 from what is currently in the IEBC.

The scoping and referencing of the seismic evaluation and design provisions is proposed to be moved out of Chapter 5 and into Chapter 1 to avoid cross referencing between the 3 compliance methods. In addition, placing the seismic provisions in Section 101.5 highlights the fact that there are several different compliance methods for seismic performance.

There editorial revisions to the remaining text of Sections 506.1 and 506.2 as well as the text that is being moved from Section 506.1.1 to new Section 101.5.4. The editorial revisions to current Section 506.1.1 where also submitted under a separate change proposal that did not include the proposed relocation of the text to Chapter 1. Refer to that change proposal for an underline-strikethrough of the proposed revisions to the current Section 506.1.1.

The proposed substantive change to Section 506.2.2.3 simplifies the evaluation and design process by eliminating the need to check wind loads for two codes. There doesn’t seem to be any reason to rehabilitate a building to wind loads in excess of the current code even if for some reason the loads were higher in the code under which the original building was designed. There is no need to exceed the requirements of the current code.

The proposed substantive change to Section 506.2.3 is a reasonable addition to the repair scope for buildings in which substantial structural damage was caused by snow. In this case, the repair and rehabilitation should strengthen the damaged building to meet current snow load requirements to minimize potential future damage. A similar proposal is being submitted on behalf of NCSEA for repairs under IBC Chapter 34.

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

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

EB2–07/08
101.5.1

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Revise as follows:

101.5.1 Prescriptive compliance method. ~~Repairs,~~ Alterations, additions and changes of occupancy complying with Chapter 3 of this code in buildings complying with the *International Fire Code* shall be considered in compliance with the provisions of this code. <u>Repairs shall comply with the requirements of the *International Fire Code*, but the entire building or structure need not, subject to the approval of the code official.</u>

Reason: The purpose of this proposed change is to bring this section into compliance with the IEBC’s stated goal of having provisions that “encourage the use and reuse of existing buildings” and “do not unnecessarily increase construction costs”. The prior version of this section required that the entire building comply with the IFC in order to make any repairs (no matter how large or small); this is not rational or cost-effective. The proposed wording requires the repair itself to conform to the IFC, which is more rational and economical, and eliminates the possibility of disproportionate upgrade costs.

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

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

EB3–07/08
104.2.1.1

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

104.2.1.1 Building evaluation. The code official is authorized to require an existing building to be investigated and evaluated by a registered design professional based on the circumstances agreed upon at the preliminary meeting ~~to determine the existence of~~. <u>The design professional shall notify the code official if</u> any potential nonconformance with the provisions of this code <u>is identified</u>.

Reason: To clarify the role of the design professional with respect to inspections required by the code official.

As written, the provision requires the designated design professional to find *any and all* potential problems with a given building. This places an undue burden (and possibly undue liability) on the design professional, who, at the time of the preliminary meeting, rarely has either complete access to the building or structure or complete knowledge of its construction and history. Compliance with the provision as currently written could result in unnecessary and expensive destructive investigation, and reasonable effort by the design professional could be deemed non-compliance.

The preferred approach, which is probably what was intended by the provision, is for the design professional to set the scope of any inspection with the code official at the preliminary meeting, then make a reasonable effort and report to the code official whatever is found. Guidelines exist to assist both the design professional and the code official with the exercise of discretion. For example, ASCE 11, Guidelines for Structural Condition Assessments, addresses appropriate investigation measures and the application of engineering judgment.

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

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

EB4–07/08
115.1, 202

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

1. Revise as follows:

115.1 Conditions. Buildings<u>, structures,</u> or ~~existing~~ equipment that are or hereafter become unsafe, ~~insanitary, or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or which constitute a fire hazard, or in which the structure or individual structural members exceed the limits established by the definition of Dangerous in Chapter 2, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe buildings~~ shall be taken down<u>,</u> ~~and~~ removed<u>,</u> or made safe~~,~~ as the code official deems necessary and as provided for in this code. ~~A vacant structure that is not secured against entry shall be deemed unsafe.~~

2. Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

<u>**UNSAFE.** Buildings, structures, or equipment that are unsanitary, or that are deficient due to inadequate means of egress facilities, inadequate light and ventilation, or that constitute a fire hazard, or in which the structure or individual structural members meet the definition of Dangerous, or that are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance shall be deemed unsafe. A vacant structure that is not secured against entry shall be deemed unsafe.</u>

3. Delete definition without substitution:

~~**UNSAFE BUILDINGS OR EQUIPMENT.** Buildings or existing equipment that is insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or that constitutes a fire hazard, or that is otherwise dangerous to human life or the public welfare or that involves illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition.~~

Reason: This proposal is editorial in nature and attempts to clarify the requirements regarding unsafe conditions.

The current code has two definitions of unsafe -- one in Section 115.1 and one in Section 202 -- and they are not identical. There is no need for two slightly different definitions of unsafe. “Insanitary” is not a word. The existing definition of “Unsafe Buildings or Equipment” has numerous grammatical problems. This proposal corrects and clarifies the definition.

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

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

EB5–07/08
115.1, 202

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

1. Revise as follows:

115.1 ~~Conditions~~ General. ~~Buildings or existing equipment that are or hereafter become unsafe, insanitary, or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or which constitute a fire hazard, or in which the structure or individual structural members exceed the limits established by the definition of Dangerous in Chapter 2, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe buildings shall be taken down and removed or made safe,~~ Unsafe conditions shall be eliminated from buildings and equipment as the code official deems necessary and as provided for in this code. ~~A vacant structure that is not secured against entry shall be deemed unsafe.~~

2. Delete definition and substitute as follows:

SECTION 202
GENERAL DEFINITIONS

~~**UNSAFE BUILDINGS OR EQUIPMENT.** Buildings or existing equipment that is insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or that constitutes a fire hazard, or that is otherwise dangerous to human life or the public welfare or that involves illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition.~~

UNSAFE. Any building or piece of equipment in any of the conditions below shall be deemed unsafe:

1. It is unsanitary.
2. It has inadequate means of egress.
3. It has inadequate light or ventilation.
4. It constitutes a fire hazard.
5. The building or any individual element is dangerous.
6. It poses a danger to human life or the public welfare due to illegal or improper occupancy or inadequate maintenance.
7. The building is vacant and not secured against entry.

Reason: The proposed change is an editorial clarification of the duplicate and slightly conflicting present text.

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

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

EB6–07/08
202

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Revise definition as follows:

SECTION 202
GENERAL DEFINITIONS

DANGEROUS. Any building or structure or ~~any individual member with~~ portion thereof that meets any of the ~~structural~~ conditions ~~or defects~~ described below shall be deemed dangerous:

~~1. The stress in a member or portion thereof due to all factored dead and live loads is more than one and one third the nominal strength allowed in the *International Building Code* for new buildings of similar structure, purpose, or location.~~
~~2. Any portion, member, or appurtenance thereof likely to fail, or to become detached or dislodged, or to collapse and thereby injure persons.~~
~~3. Any portion of a building, or any member, appurtenance, or ornamentation on the exterior thereof is not of sufficient strength or stability, or is not anchored, attached, or fastened in place so as to be capable of resisting a wind pressure of two thirds of that specified in the *International Building Code* for new buildings of similar structure, purpose, or location without exceeding the nominal strength permitted in the *International Building Code* for such buildings.~~
~~4. The building, or any portion thereof, is likely to collapse partially or completely because of dilapidation, deterioration or decay; construction in violation of the *International Building Code*; the removal, movement or instability of any portion of the ground necessary for the purpose of supporting such building; the deterioration, decay or inadequacy of its foundation; damage due to fire, earthquake, wind or flood; or any other similar cause.~~
~~5. The exterior walls or other vertical structural members list, lean, or buckle to such an extent that a plumb line passing through the center of gravity does not fall inside the middle one third of the base.~~
1. <u>The building or structure has collapsed, partially collapsed, moved off its foundation, or lacks the support of any portion of ground necessary to support it.</u>
2. <u>There exists a significant risk of collapse, detachment, or dislodgment of any portion, member, appurtenance, or ornamentation of the building or structure under typical day-to-day service loads.</u>

Reason: The purpose of this proposed change is to clarify the language of the IEBC and make the definition of the word "dangerous" more in line with the common engineering understanding of the word and to preclude structures that are not significantly distressed or even not distressed at all (e.g. older wood structures that had much higher allowable stresses at the time they were permitted, structures with older materials that are no longer allowed by the IBC, older claddings that had much lower design wind loads at the time they were designed, etc.) from being improperly deemed dangerous.

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

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

EB7–07/08

501.1, 501.2, 502.1, 502.2, 506.2.1, 506.2.2.3, 506.2.3, 506.2.3.1

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

1. Revise as follows:

501.1 Scope. Repairs as described in Section ~~302~~ <u>402</u> shall comply with the requirements of this chapter. Repairs to historic buildings shall comply with this chapter, except as modified in Chapter 11.

2. Delete without substitution:

~~**501.2 Permitted materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted, provided no hazard to life, health or property is created.~~

3. Delete and substitute as follows:

~~**502.1 Hazardous materials.** Hazardous materials that are no longer permitted, such as asbestos and lead-based paint, shall not be used.~~

<u>**502.1 Existing building materials.** Materials already in use in a building in conformance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the code official to render the building or structure unsafe or dangerous as defined in Chapter 2.</u>

<u>**502.2 New and replacement materials.** Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided no dangerous or unsafe condition, as defined in Chapter 2, is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.</u>

(Renumber subsequent sections)

4. Revise as follows:

506.2.1 Dangerous conditions. Regardless of the extent of structural or nonstructural damage, ~~dangerous conditions shall be eliminated~~ the code official shall have the authority to require the elimination of conditions deemed dangerous.

506.2.2.3 Extent of repair for noncompliant buildings. If the evaluation does not establish compliance of the ~~predamaged~~ pre-damaged building in accordance with Section 506.2.2.1, then the building shall be rehabilitated to comply with applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces. The wind design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the design level shall be as required by the code in effect at the time of original construction or as required by the *International Building Code*, whichever is greater. Seismic forces for this rehabilitation design shall be those required for the design of the ~~predamaged~~ pre-damaged building, but not less than the reduced level seismic forces specified in Section 506.1.1.3. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

506.2.3 Substantial structural damage to ~~vertical~~ gravity load-carrying components. ~~Vertical~~ Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the *International Building Code*. Undamaged ~~vertical~~ gravity load-carrying components that receive dead or live loads from rehabilitated components shall also be rehabilitated or shown to have the capacity to carry the design loads of the rehabilitation design. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

506.2.3.1 Lateral-force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to ~~vertical~~ gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 506.2.2.1 and, if noncompliant, rehabilitated in accordance with Section 506.2.2.3.

Reason: The proposal is entirely editorial and is submitted in coordination with separate proposals to IBC Chapter 34. The proposal makes the following edits:

- Current section 501.1: Correct an incorrect section reference.
- Current section 501.2: Move to section 502.1, where permitted materials are more properly addressed.
- Current section 501.2 and 502.1: Incorporate into proposed sections 502.2. Add section 502.1 to distinguish existing materials from new materials. The wording for proposed section 502.1 is similar to language introduced to IBC section 3403 with the 07 supplement, with reference to the terms Dangerous and Unsafe, which are defined only in the IEBC.
- Current section 506.2.1: Coordinate with proposed changes to IBC Chapter 34.
- Current section 506.2.2.3: Correct incorrect section reference. Replace "predamaged" (which means "damaged in advance") with "pre-damage" (which means prior to the damage).
- Current sections506.2.3 and 506.2.3.1: Coordinate with proposed changes to IBC Chapter 34, replacing "vertical" with "gravity" for clarity.

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

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

EB8–07/08
501.4

Proponent: William Easterling, Grand Haven, MI, representing himself

Revise as follows:

501.4 Flood hazard areas. In flood hazard areas, repairs below the design flood elevation shall comply with Section 1612 of the *International Building Code* or Section 324 of the *International Residential Code*. Repairs that constitute substantial improvement shall require that the building comply with Section 1612 of the *International Building Code* or Section 324 of the *International Residential Code.*

Reason: The purpose of the proposed code change is to give better direction on where to go depending on the type of structure, being either the *International Building Code* or the *International Residential Code* when dealing with a flood hazard area. This code change proposal also brings the IEBC more inline with the *International Residential Code* by requiring that any new materials installed below the design flood elevation be the same as what is required for a new building. Like with other hazards (snow, wind, etc…) that become known of or better understood after a structure is built, any subsequent repairs and alterations to an existing structure should be afforded same the minimum protections as established for new structures.

Such enforcement will incrementally provide, at least to the repair undertaken, the already established minimum protection for new structures from the known hazard of floods; which when enforced properly does protect emergency responders from falling through a residential floor that was repaired with 5/8" flood-resistant floor sheathing 16" O.C. in a flood situation as opposed to if no flood-resistant materials were used on the repair. Additionally consistent enforcement of flood-resistant material requirements on repairs will help reduce repetitive losses and assist in keeping future repair costs from reaching the substantial damage threshold.

The proposed code clarification is also inline with 44CFR60.3.3 – Floodplain Management Criteria for Flood-Prone Areas; which requires a local jurisdiction participating in FEMA's National Flood Insurance Program to "Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, (ii) be constructed with materials resistant to flood damage, (iii) be constructed by methods and practices that minimize flood damages, and (iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding."

Likewise according to federal law, being 44CFR60.1.d, FEMA encourages jurisdictions to adopt more comprehensive floodplain management regulations such as what *International Residential Code* has already done with plain meaning of Section R102.7.1, Section R301.2.4, and Section R324. Federal law states in part at 44CFR60.1.d that: "Any community may exceed the minimum criteria under this part by adopting more comprehensive flood plain management regulations … Therefore, any flood plain management regulations adopted by a State or a community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence".

Cost Impact: The code change proposal will increase the cost of construction.

This code change will incrementally increase the first cost of construction; however given the known fact of a flood hazard and the design flood elevation it will only be matter of time before the initial incremental cost will be recognized as a savings.

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

EB9–07/08
506

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

SECTION 506
STRUCTURAL

506.1 General. ~~Repairs of structural elements shall comply with this section.~~ <u>Structural repairs shall be in compliance with this section and Section 501.3. Regardless of the extent of structural or nonstructural damage, the code official shall have the authority to require the elimination of conditions deemed dangerous. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.</u>

506.1.1 Seismic evaluation and design. Seismic evaluation and design of an existing building and its components shall be based on the following criteria.

506.1.1.1 Evaluation and design procedures. The seismic evaluation and design shall be based on the procedures specified in the *International Building Code*, ASCE 31 or ASCE 41. The procedures contained in Appendix A of this code shall be permitted to be used as specified in Section 506.1.1.3.

506.1.1.2 (Supp) <u>Compliance with</u> IBC level seismic forces. ~~When seismic forces are required to meet the *International Building Code* level, they shall be one of the following:~~ <u>Where compliance with the seismic design provisions of the *International Building Code* is required, the procedures shall be in accordance with one of the following:</u>

1. ~~One-hundred percent of the values in~~ The *International Building Code* <u>using one-hundred percent of the prescribed forces</u>. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special."
2. ~~Those associated with~~ <u>Compliance with ASCE 41 using both</u> the BSE-1 and BSE-2 Earthquake Hazard Levels ~~defined in ASCE 41. Where ASCE 41 is used,~~ <u>and</u> the corresponding performance levels ~~shall be those~~ shown in Table 506.1.1.2.

TABLE 506.1.1.2 (Supp)
~~ASCE 41 AND ASCE 31 PERFORMANCE LEVELS~~
PERFORMANCE CRITERIA FOR IBC LEVEL SEISMIC FORCES

OCCUPANCY CATEGORY (Based on IBC Table 1604.5)	PERFORMANCE LEVEL FOR USE WITH ~~ASCE 31 AND WITH~~ ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL	PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-2 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Collapse Prevention (CP)
II	Life Safety (LS)	Collapse Prevention (CP)
III	Note a	Note a
IV	Immediate Occupancy (IO)	Life Safety (LS)

a. Performance levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

506.1.1.3 (Supp) Compliance with reduced IBC level seismic forces. ~~When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:~~ Where seismic evaluation and design is permitted to meet reduced *International Building Code* seismic force levels, the procedures used shall be in accordance with one of the following:

1. The *International Building Code* using seventy-five percent of the prescribed forces ~~prescribed in the *International Building Code*~~. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor as specified in Section 506.1.1.2 of this code.
2. ~~In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below.~~ Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.5 shall be deemed to comply with ~~the requirements for reduced *International Building Code* force levels~~ this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.
   - 2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.
3. ~~In accordance with~~ Compliance ASCE 31 based on the applicable performance level as shown in Table ~~506.1.1.2~~ 506.1.1.3.
4. ~~Those associated with~~ Compliance with ASCE 41 using the BSE-1 Earthquake Hazard Level ~~defined in ASCE 41~~ and the performance level as shown in Table ~~506.1.1.2~~ 506.1.1.3. ~~Where ASCE 41 is used,~~ The design spectral response acceleration parameters S_{XS} and S_{X1} specified in ASCE 41shall not be taken less than 75 percent of the respective design spectral response acceleration parameters S_{DS} and S_{D1} defined by the *International Building Code* ~~and its reference standards~~.

TABLE 506.1.1.3
PERFORMANCE CRITERIA FOR REDUCED IBC LEVEL SEISMIC FORCES

OCCUPANCY CATEGORY (Based on IBC Table 1604.5)	PERFORMANCE LEVEL FOR USE WITH ASCE 31	PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Life Safety (LS)
II	Life Safety (LS)	Life Safety (LS)
III	Note a	Note a
IV	Immediate Occupancy (IO)	Immediate Occupancy (IO)

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

506.1.2 Wind design. Wind design of existing buildings shall be based on the procedures specified in the *International Building Code* or *International Residential Code* as applicable.

506.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

~~**506.2.1 Dangerous conditions.** Regardless of the extent of structural damage, dangerous conditions shall be eliminated.~~ *Moved to Section 506.1*

506.2.1 Repairs for less than substantial structural damage. For damage less than substantial structural damage, the damaged elements shall be restored to their pre-damage condition.

506.2.2 Repairs for substantial structural damage to vertical elements of the lateral-force-resisting system. A building that has sustained substantial structural damage to the vertical elements of its lateral-force-resisting system shall be evaluated ~~and repaired~~ in accordance with ~~the applicable provisions of~~ Section~~s~~ 506.2.2.1 ~~through 506.2.2.3~~, and either repaired in accordance with Section 506.2.2.2 or repaired and rehabilitated in accordance with Section 506.2.2.3 depending on the results of the evaluation.

506.2.2.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamaged state, would comply with the provisions of the *International Building Code*~~. Wind forces for this evaluation shall be those prescribed in the *International Building Code*. Seismic forces for this evaluation are~~, except that the seismic design criteria shall be the reduced level seismic forces specified in Section 506.1.1.3.

506.2.2.2 Extent of repair for compliant buildings. If the evaluation establishes ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then ~~repairs shall be permitted that restore the building to its predamaged state using materials and strengths that existed prior to the damage~~ the damaged elements shall be permitted to be restored to their pre-damage condition.

506.2.2.3 Extent of repair for noncompliant buildings. If the evaluation does not establish ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then the building shall be rehabilitated to comply ~~with applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces~~ the provisions of this section. The wind ~~design level~~ load for the repair and rehabilitation shall be ~~as~~ those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the ~~design level shall be as required by the code in effect at the time of original construction or as required by~~ wind loads shall be in accordance with the *International Building Code*~~, whichever is greater~~. The seismic ~~forces~~ loads for this rehabilitation design shall be those required ~~for the design of the predamaged building~~ by the building code in effect at the time of original construction, but not less than the reduced level seismic forces specified in Section 506.1.1.3. ~~New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

506.2.3 Substantial structural damage to ~~vertical~~ gravity load-carrying components. ~~Vertical~~ Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the *International Building Code*. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects. Undamaged ~~vertical~~ gravity load-carrying components that receive dead, ~~or~~ live or snow loads from rehabilitated components shall also be rehabilitated ~~to carry~~ if required to comply with the design loads of the rehabilitation design. ~~New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

506.2.3.1 Lateral-force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to ~~vertical~~ gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 506.2.2.1 and, if noncompliant, rehabilitated in accordance with Section 506.2.2.3.

~~**506.2.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its predamaged state using materials and strengths that existed prior to the damage. New structural members and connections used for this repair shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~**506.2.5**~~ **506.2.4 Flood hazard areas.** In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the *International Building Code*.

Reason: The proposal is primarily editorial with revisions serving the following purposes.

1. Makes editorial clarifications to Section 506.1 and 506.2 to improve clarity, flow, and delete redundant and unnecessary text.
2. Makes editorial clarifications to the seismic evaluation and design provisions in Sections 506.1.1.2 and 506.1.1.3. Intent is to focus on design criteria, compliance, and loads, rather than on forces.
3. Splits Table 506.1.1.2 into two tables, one for full IBC forces and one for reduced IBC forces for added clarity. Clarifies differences between repair (fixing damage) and rehabilitation (additional upgrades triggered by the extent of repair and conformance of the existing building) for added clarity.
4. Moves the text of current Section 506.2.1 to Section 506.1 for improved scoping and to ensure that requirement applies to all repairs.
5. In Section 506.2 the requirements for less than substantial damage are moved before those for substantial damage for improved usability.
6. Makes the following substantive revisions to 506.2:
   a. 506.2.2.3: requires rehabilitation to IBC wind loads, instead of the greater of the IBC and the code under which the original design was done.
   b. 506.2.3: includes evaluation of snow load criteria if the damage was caused by snow.

The editorial revisions improve the clarity and flow of the section.

The proposed substantive change to Section 506.2.2.3 simplifies the evaluation and design process by eliminating the need to check wind loads for two codes. There doesn't seem to be any reason to rehabilitate a building to wind loads in excess of the current code even if for some reason the loads were higher in the code under which the original building was designed. There is no need to exceed the requirements of the current code.

The proposed substantive change to Section 506.2.3 is a reasonable addition to the repair scope for buildings in which substantial structural damage was caused by snow. In this case, the repair and rehabilitation should strengthen the damaged building to meet current snow load requirements to minimize potential future damage. A similar proposal is being submitted on behalf of NCSEA for repairs under IBC Chapter 34.

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

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

EB10–07/08
506.1.1.2, 506.1.1.3

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

506.1.1.2 (Supp) IBC level seismic forces. When seismic forces are required to meet the *International Building Code* level, they shall be one of the following:

1. One-hundred percent of the values in the *International Building Code*. ~~The *R*-factor~~ <u>Values of *R*, Ω_0, and C_d</u> used for analysis in accordance with Chapter 16 of the *International Building Code* shall be ~~the *R*-factor~~ <u>those</u> specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it ~~can be~~ <u>is</u> demonstrated that the structural system ~~satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special."~~ <u>will provide performance equivalent to that of an "Intermediate" or "Special" system.</u>
2. Those associated with the BSE-1 and BSE-2 Earthquake Hazard Levels defined in ASCE 41. Where ASCE 41 is used, the corresponding performance levels shall be those shown in Table 506.1.1.2.

506.1.1.3 (Supp) Reduced IBC level seismic forces. When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:

1. Seventy-five percent of the forces prescribed in the *International Building Code*. ~~The *R*-factor~~ <u>Values of *R*, Ω_0, and C_d</u> used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor as specified in Section 506.1.1.2 of this code.
2. In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A shall be deemed to comply with the requirements for reduced *International Building Code* force levels.
   2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of lightframe wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.

2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.

3. In accordance with ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2.
4. Those associated with the BSE-1 Earthquake Hazard Level defined in ASCE 41 and the performance level as shown in Table 506.1.1.2. Where ASCE 41 is used, the design spectral response acceleration parameters *SXS* and *SX1* shall not be taken less than 75 percent of the respective design spectral response acceleration parameters *SDS* and *SD1* defined by the *International Building Code* and its reference standards.

Reason: To improve usability and to ensure complete and appropriate application of Chapter 16 code provisions to existing buildings. The proposal:

- addresses all three seismic design parameters, not just *R*.
- changes the bright line criteria established by the IBC's "proportioning and detailing requirements" for new structures to a more appropriate criterion based on equivalent performance.

These sections require the engineer to identify the seismic force-resisting system of the existing or rehabilitated building. In many cases, the existing building will not possess the detailing necessary to qualify for "Special" or even "Intermediate" systems. If the detailing is unknown or inadequate, the current provisions properly require use of design parameters for "Ordinary" systems.

However, the current provisions would require the existing building to meet the letter of the IBC's prescriptive requirements for proportioning and detailing, which is problematic and sometimes inappropriate for existing buildings. This proposal would replace the current prescriptive criteria with a requirement for equivalent performance, which can be demonstrated in a number of ways. (For example, some or all of the criteria used by the IBC for undefined structural systems or for change of occupancy in IBC Section 3406.4 may be applied as appropriate.) The performance-based criterion is preferable because for many existing buildings there are no applicable provisions to check against. Also, "equivalent performance" preserves some engineering and regulatory discretion appropriate to work with existing buildings.

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

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

EB11–07/08
Table 506.1.1.2

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise table as follows:

TABLE 506.1.1.2 (Supp)
ASCE 41 AND ASCE 31 PERFORMANCE LEVELS

OCCUPANCY CATEGORY (Based on IBC Table 1604.5)	PERFORMANCE LEVEL FOR USE WITH ASCE 31 AND WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL	PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-2 EARTHQUAKE HAZARD LEVEL
I	Life Safety (LS)	Collapse Prevention (CP)
II	Life Safety (LS)	Collapse Prevention (CP)
III	Note a<u>, Note b</u>	Note a
IV	Immediate Occupancy (IO)	Life Safety (LS)

a. ~~Performance levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.~~ <u>Acceptance criteria for Occupancy Category III shall be taken as 80 percent of the acceptance criteria specified for Occupancy Category II performance levels, but need not be less than the acceptance criteria specified for Occupancy Category IV performance levels.</u>

<u>b.</u> <u>For Occupancy Category III, the ASCE 31 Screening Phase checklists shall be based on the Life Safety performance level.</u>

Reason: This proposal intends to solve a problem with the performance level scoping in the 2006 IEBC. The interpolation specified for Occupancy Category III is confusing and potentially inconsistent with the IBC where ASCE 41 is used and is generally incompatible with ASCE 31. This proposal revises the Occupancy Category III interpolation for buildings where full or reduced IBC level seismic forces are required.

For ASCE 41, the interpolation is changed to require the acceptance criteria to be 25 percent more restrictive for Occupancy Category III, but not more restrictive than for Occupancy Category IV. This is more consistent with the Importance Factor equal to 1.25 for Occupancy Category III structures used in the IBC (IBC Section 1604) rather than interpolating between two ASCE 41 performance levels which do not clearly correlate to the IBC seismic design criteria. Since the ASCE 41 methodology has the acceptance criteria (m-factors or nonlinear rotation) on the capacity side of the demand vs capacity equation, using 80 percent of the acceptance criteria is the same as a 25 percent increase on the demand side.

For ASCE 31, the same procure is used for acceptance criteria, except for the Screening Phase (ASCE 31 Chapter 3). The Screening Phase is the initial phase of an evaluation and is based on checklists to determine conformance or non-conformance with statements covering various features of the seismic-force-resisting system. In most cases it is difficult or impossible to interpolate between Life Safety and Immediate Occupancy acceptance criteria when using these checklists. Therefore, the second part of this revision (added Note b) eliminates the incompatibility with the current interpolation where ASCE 31 is used. The ASCE 31 checklists are sufficiently conservative for the initial screening phase so that the less restrictive Life Safety performance level will not significantly compromise the overall seismic performance goals for Occupancy Category III buildings.

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

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

EB12–07/08
506.1.1.3

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

506.1.1.3 (Supp) Reduced IBC level seismic forces. When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:

1. Seventy-five percent of the forces prescribed in the *International Building Code*. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor as specified in Section 506.1.1.2 of this code.
2. In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A shall be deemed to comply with the requirements for reduced *International Building Code* force levels.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of lightframe wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.
   - 2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.
3. In accordance with ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2. <u>It shall be permitted to use the BSE-1 earthquake hazard level as defined in ASCE 41 and subject to the limitations in Item 4 below.</u>
4. Those associated with the BSE-1 Earthquake Hazard Level defined in ASCE 41 and the performance level as shown in Table 506.1.1.2. Where ASCE 41 is used, the design spectral response acceleration parameters *SXS* and *SX1* shall not be taken less than 75 percent of the respective design spectral response acceleration parameters *SDS* and *SD1* defined by the *International Building Code* and its reference standards.

Reason: To establish consistency between the seismic hazard level used in ASCE 31 and ASCE 41. ASCE 41-06, just published this year, specifies a design level earthquake as lesser of 10%/50yr and 2/3 MCE. ASCE 31 specifies 2/3MCE. It doesn't make sense to evaluate a building (ASCE 31) for a higher level of seismic hazard than the rehabilitation (ASCE 41).

The 10%/50yr hazard is consistent with traditional criteria for seismic upgrades and design of new buildings in high seismic regions under the Uniform Building Code. Based on this, the commentary to ASCE 31 indicates that it can be an appropriate seismic hazard for use in evaluating existing buildings (ASCE 31 Section C3.5.2.3.1).

Since ASCE 41 is the more recently published of the two standards, the fact that this standard was published with the recommended seismic hazard as the lesser of 10%/50yr and 2/3 MCE, reaffirms the intent of the ASCE Seismic Rehabilitation Standards Committee to move forward with this hazard.

Note that if ASCE 31-08 is published with a revised seismic hazard, this proposal will be reconsidered.

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

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

EB13–07/08
506.1

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Delete and substitute as follows:

~~**506.1 General.** Repairs of structural elements shall comply with this section.~~
~~**506.1.1 Seismic evaluation and design.**~~
~~**506.1.1.1 (Supp) Evaluation and design procedures.**~~
~~**506.1.1.2 (Supp) IBC level seismic forces.**~~

~~**TABLE 506.1.1.2 (Supp)**~~
~~**FEMA 356 AND ASCE 31 PERFORMANCE LEVELS**~~

~~**506.1.1.3 (Supp) Reduced IBC level seismic forces.**~~
~~**506.1.2 Wind design.**~~
~~**506.2 Repairs to damaged buildings.**~~
~~**506.2.1 Dangerous conditions.**~~
~~**506.2.2 Substantial structural damage to vertical elements of the lateral-force-resisting system.**~~
~~**506.2.2.1 Evaluation.**~~
~~**506.2.2.2 Extent of repair for compliant buildings.**~~
~~**506.2.2.3 Extent of repair for noncompliant buildings.**~~
~~**506.2.3 Substantial structural damage to vertical load-carrying components.**~~
~~**506.2.3.1 Lateral-force-resisting elements.**~~
~~**506.2.4 Less than substantial structural damage.**~~
~~**506.2.5 Flood hazard areas.**~~
506.1 General. Repairs of structural elements shall conform to the requirements of the *International Building Code*. Repairs shall be done in a manner that maintains the level of protection for the structural system.

Reason: This proposal brings the structural repairs section of the IEBC back into line with the rest of the repair sections, including repairs to fire protection, means of egress, accessibility, electrical, and plumbing. This proposal also brings the IEBC back in line with prior codes and with the current IBC. The current structural repairs section was apparently written by California seismic engineers -- since the primary focus of this section is seismic. Yet most damage to existing buildings even in California is not caused by seismic events -- fires, vehicle impacts, decay and deterioration are much more common than earthquakes -- and damage far more buildings than earthquakes. Consequently, the emphasis on seismic damage is completely inappropriate for the entire country, including California. Even if requiring seismic upgrades as a result of a fire or vehicle impact were somehow rational (which it is not), the existing triggers are not rational and may result in disproportionate upgrade costs that dwarf the cost of repairs, discouraging legal permitted repairs. Requiring the repair to conform to the requirements of the IBC will bring the IEBC back to its purported goal of having provisions that "encourage the use and reuse of existing buildings" and "do not unnecessarily increase construction costs" and yet will maintain and even gradually improve the existing building stock in a manner that is not egregious, economically unsustainable, or unethical.

Sections 506.1.1.1, 506.1.1.2, and 506.1.1.3 are referenced by several other Chapters and do not really belong in Chapter 5 (which only governs repairs). Force levels used by multiple chapters should be located either in Chapter 4 or in a new Chapter between current Chapters 4 and 5.

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

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

EB14–07/08
202, 506.2.1, 506.2.2-506.2.5

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IEBC AND THE IBC STRUCTURAL CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IEBC

1. Revise as follows:

506.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

506.2.1 Dangerous conditions. Regardless of the extent of ~~structural~~ damage, dangerous conditions shall be eliminated.

2. Delete and substitute as follows:

~~**506.2.2 Substantial structural damage to vertical elements of the lateral-force-resisting system.** A building that has sustained substantial structural damage to the vertical elements of its lateral-force-resisting system shall be evaluated and repaired in accordance with the applicable provisions of Sections 506.2.2.1 through 506.2.2.3.~~

~~**506.2.2.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamaged state, would comply with the provisions of the *International Building Code*. Wind forces for this evaluation shall be those prescribed in the *International Building Code*. Seismic forces for this evaluation are permitted to be the reduced level seismic forces specified in Section 506.1.1.3.~~

~~**506.2.2.2 Extent of repair for compliant buildings.** If the evaluation establishes compliance of the predamaged building in accordance with Section 506.2.2.1, then repairs shall be permitted that restore the building to its predamaged state using materials and strengths that existed prior to the damage.~~

~~**506.2.2.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish compliance of the predamaged building in accordance with Section 506.2.2.1, then the building shall be rehabilitated to comply with applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces. The wind design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the design level shall be as required by the code in effect at the time of original construction or as required by the *International Building Code*, whichever is greater. Seismic forces for this rehabilitation design shall be those required for the design of the predamaged building, but not less than the reduced level seismic forces specified in Section 506.1.1.3. Newstructural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~**506.2.3 Substantial structural damage to vertical load-carrying components.**Vertical load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the *International Building Code*. Undamaged vertical load-carrying components that receive dead or live loads from rehabilitated components shall also be rehabilitated to carry the design loads of the rehabilitation design. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~**506.2.3.1 Lateral-force-resisting elements.** Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to vertical load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 506.2.2.1 and, if noncompliant, rehabilitated in accordance with Section 506.2.2.3.~~

~~**506.2.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its predamaged state using materials and strengths that existed prior to the damage. New structural members and connections used for this repair shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

~~**506.2.5 Flood hazard areas.** In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the *International Building Code*.~~

<u>**506.2.2 Less than substantial damage.** For damage less than substantial damage, repairs shall be allowed that restore the building to its predamaged state using materials and strengths that existed prior to the damage. New structural members and connections used for this repair shall comply with the detailing provisions of the International Building Code for new buildings of similar structure, purpose, and location.</u>

<u>**506.2.3 Substantial damage.** Buildings and structures that have sustained substantial damage shall be brought into substantial compliance with the International Building Code. The wind design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the design level shall be as required by the code in effect at the time of original construction or as required by the International Building Code, whichever is greater. Seismic forces for this upgrade design shall be those required for the design of the predamaged building, but not less than the reduced level seismic forces specified in Section 506.1.1.3.</u>

PART II – IBC STRUCTURAL

SECTION 202
GENERAL DEFINITIONS

1. Revise as follows:

[B] SUBSTANTIAL DAMAGE. ~~For the purpose of determining compliance with the flood provisions of this code,~~ Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

2. Delete without substitution:

~~**[B] SUBSTANTIAL STRUCTURAL DAMAGE.** A condition where:~~

1. ~~In any story, the vertical elements of the lateral-force-resisting system have suffered damage such that the lateral load-carrying capacity of the structure in any horizontal direction has been reduced by more than 20 percent from its predamaged condition; or~~
2. ~~The capacity of any vertical gravity load-carrying component, or any group of such components, that supports more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its predamaged condition and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the *International Building Code* for new buildings of similar structure, purpose and location.~~

Reason: The purpose of this proposed change is to bring this section into compliance with the IEBC's stated goal of having provisions that "encourage the use and reuse of existing buildings" and "do not unnecessarily increase construction costs" and to make the repair provisions and upgrade triggers in the IEBC make sense from an economic standpoint.

Using a trigger as ill-defined as "loss-of-capacity" does not make sense, since with the possible exception of FEMA 306, 307, and 308 (which only address reinforced concrete and masonry shearwalls), no generally agreed-upon methods exist for determining "loss-of-capacity" for any structural material or system. Using such an ill-defined trigger will adversely affect standard of care, result in uncertainty as to what is required, and generate significant dispute.

Since damage to a few elements can arguably cause an entire structure to lose "capacity", the cost of the required upgrades can dwarf the cost of the repairs -- sometimes by orders of magnitude. As ICBO has recognized, disproportionate upgrade costs provide a financial disincentive to repair the structure and can lead to deterioration of building stock (*Handbook to the Uniform Building Code*, ICBO, 1998). Furthermore, with the exception of wind damage, the upgrades triggered by "substantial structural damage" are not even linked by causation to the damage. Linking upgrade triggers to "loss-of-capacity" is not rational, can result in disproportionate, extremely costly and even unnecessary upgrades, and can easily lead to dispute between the various interested parties.

A much more rational test as to whether a required upgrade is reasonable is to link the trigger to the cost of the repair. The intent of the change is to require upgrade triggers similar to those required for Flood Hazard Areas, which are rational and reasonable and link the upgrade trigger to significant damage in a quantifiable way.

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

PART I – IEBC

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

PART II – IBC STRUCTURAL

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

EB15–07/08
506.2.2.3

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Revise as follows:

506.2.2.3 Extent of repair for noncompliant buildings. If the evaluation does not establish compliance of the predamaged building in accordance with Section 506.2.2.1, then the building shall be rehabilitated to comply with applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces. The wind design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the design level shall be as required by the code in effect at the time of original construction or as required by the *International Building Code*, whichever is greater. <u>The seismic design level for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by earthquake and the damage caused was disproportionate to the intensity of the earthquake at the site of the building or structure, in which case,</u> seismic forces for this rehabilitation design shall be those required for the design of the predamaged building, but not less than the reduced level seismic forces specified in Section 506.1.1.3. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

Reason: This proposal brings the structural repairs section of the IEBC more into line with respect to the overall stated goals of the IEBC. In this proposal, the seismic upgrade portion of the structural repairs section has been made similar to the requirements relating to wind and makes the requirements more rational -- only requiring seismic upgrade if the damage was caused by earthquake and if the damage was disproportionate to the intensity of the earthquake at the site of the building or structure. If a building or structure experiences a minor earthquake and has significant structural damage, upgrade of that structure may be prudent, but if a building or structure experiences a major earthquake (on the order of the design-level event) and only has minor to moderate damage (even if such damage is considered substantial structural damage), then the building has performed in accordance with the intent of the code and survived a design level event and no upgrade would be warranted.

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

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

EB16–07/08
601.3

Proponent: William Easterling, Grand Haven, MI, representing himself

Revise as follows:

601.3 Flood hazard areas. In flood hazard areas, alterations that constitute substantial improvement shall require that the building comply with Section 1612 of the *International Building Code* <u>or Section 324 of the *International Residential Code.* Alterations below the design flood elevation shall comply with Section 1612 of *the International Building Code* or Section 324 of the *International Residential Code*</u>.

Reason: The purpose of the proposed code change is to give better direction on where to go depending on the type of structure, being either the *International Building Code* or the *International Residential Code* when dealing with a flood hazard area. This code change proposal also brings the IEBC more inline with the *International Residential Code* by requiring that any new materials installed below the design flood elevation be the same as what is required for a new building. Like with other hazards (snow, wind, etc…) that become known of or better understood after a structure is built, any subsequent repairs and alterations to an existing structure should be afforded same the minimum protections as established for new structures.

Such enforcement will incrementally provide, at least to the alteration undertaken, the already established minimum protection for new structures from the known hazard of floods; which when enforced properly does protect emergency responders from falling through a residential floor that was altered with 5/8” flood-resistant floor sheathing 16” O.C. in a flood situation as opposed to if no flood-resistant materials were used on the alteration. Additionally consistent enforcement of flood-resistant material requirements on alterations will help reduce repetitive losses and assist in keeping future repair costs from reaching the substantial damage threshold.

The proposed code clarification is also inline with 44CFR60.3.3 – Floodplain Management Criteria for Flood-Prone Areas; which requires a local jurisdiction participating in FEMA’s National Flood Insurance Program to “Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding. If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (i) be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, (ii) be constructed with materials resistant to flood damage, (iii) be constructed by methods and practices that minimize flood damages, and (iv) be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.”

Likewise according to federal law, being 44CFR60.1.d, FEMA encourages jurisdictions to adopt more comprehensive floodplain management regulations such as what *International Residential Code* has already done with plain meaning of Section R102.7.1, Section R301.2.4, and Section R324. Federal law states in part at 44CFR60.1.d that: “Any community may exceed the minimum criteria under this part by adopting more comprehensive flood plain management regulations … Therefore, any flood plain management regulations adopted by a State or a community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence”.

Cost Impact: The code change proposal will increase the cost of construction.

This code change will incrementally increase the first cost of construction; however given the known fact of a flood hazard and the design flood elevation it will only be matter of time before the initial incremental cost will be recognized as a savings.

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

EB17–07/08
602.1, 602.2, 602.3 (New)

Proponent: Marcelo M. Hirschler, GBH International, representing American Fire Safety Council

1. Revise as follows:

602.1 (Supp) Interior finishes. All newly installed interior wall and ceiling finishes shall comply with the flame spread index and smoke-developed index requirements of Chapter 8 of the *International Building Code*.

602.2 ~~Carpeting~~ Interior floor finish. New interior floor finish, including new carpeting used as an interior floor finish material shall comply with the critical radiant flux and other requirements of Section 804 of the *International Building Code*.

2. Add new text as follows:

602.3 Interior trim. All newly installed interior trim materials shall comply with the requirements of Section 806 of the *International Building Code*.

(Renumber subsequent section)

Reason: This change is basically clarification.

Chapter 8 of the IBC has requirements for flame spread index and smoke-developed index (and alternative approaches based on heat release requirements from testing in a room-corner test) for interior wall and ceiling finishes. The amended wording clarifies that the smoke-developed index requirements must also be met and that the alternate requirements, based on a room-corner test (such as NFPA 286) instead of being based on testing for flame spread index and smoke-developed index by ASTM E 84, as permitted by the IBC, are also permitted for alterations of existing buildings.

Section 804 of the IBC addresses requirements for interior floor finish and not only carpeting. Also, the requirements of section 804 are slightly broader than just critical radiant flux.

Section 806 of the IBC (or section 804 of the IFC) addresses requirements for interior trim materials and those should also be complied with when alterations are made in existing buildings.

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

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

EB18–07/08
605.1, 605.1.8, 605.1.9 (New)

Proponents: Dominic Marinelli, United Spinal Association; Deb A. Cotter, National Council on Independent Living (NCIL); Marilyn Golden, Disability Rights Education and Defense Fund; Susan Prokop, Paralyzed Veterans of America; Anne Sommers, American Association of People with Disabilities; Elinor Ginzler, (AARP) American Association of Retired Persons

Revise as follows:

605.1 General. A building, facility or element that is altered shall comply with the applicable provisions in Sections 605.1.1 through 605.1.12, Chapter 11 of the *International Building Code* and ICC A117.1 unless it is technically infeasible. Where compliance with this section is technically infeasible, the alteration shall provide access to the maximum extent that is technically feasible. A building, facility or element that is constructed or altered to be accessible shall be maintained accessible during occupancy.

Exceptions:

1. The altered element or space is not required to be on an accessible route unless required by Section 605.2.
2. Accessible means of egress required by Chapter 10 of the *International Building Code* are not required to be provided in existing buildings and facilities.
3. Type B dwelling or sleeping units required by Section 1107 of the *International Building Code* are not required to be provided in existing ~~buildings and facilities~~ structures for which an occupancy permit was first issued prior to March 13, 1991 and where Type B dwelling units were not required at the time of first occupancy in buildings designed and constructed after March 13, 1991.

4. The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall meet the provisions for Type B dwelling units and shall comply with the applicable provisions in Chapter 11 of the *International Building Code* and ICC A117.1.

Reason: The code change is necessary to ensure that Type B features be provided or maintained when alterations are done to a multifamily dwelling that was previously covered under the Federal Fair Housing Amendments Act's Accessibility Guidelines (i.e., was first occupied after March 13, 1991).

Adding <u>and where Type B dwelling units were not required at the time of first occupancy in buildings designed and constructed after March 13, 1991</u> will ensure that permit applicants will comply with the FH Act and avoid complaints and litigation.

The proposal is an effort to not have the building code sanction past violations of the Federal Fair Housing Act. If a residential facility was required to provide Type B units at the time it was constructed, the building code cannot waive this obligation at the time the building is altered. If an occupancy permit was first issued prior to March 13, 1991, Type B units were not required by the Fair Housing Act or the building code. Similarly, certain residential facilities, such as multi-story dwellings are not required to provide Type B units even if they were constructed subsequent to March 13, 1991. However, if a structure was required to provide Type B units and those units were not provided or they were altered below the requirements of the code, the Type B units must be provided to ensure that the facility meets the requirements of the Federal Fair Housing Act.

Cost Impact: The code change proposal will not increase the cost of construction – merely reflects Federal Fair Housing Amendments Act Accessibility Guidelines.

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

EB19–07/08

605.1.8, 605.1.9 (New), 706.3, 706.4 (New), 706.5 (New), 806.1

Proponents: Dominic Marinelli, United Spinal Association; Deb A. Cotter, National Council on Independent Living (NCIL); Marilyn Golden, Disability Rights Education and Defense Fund; Susan Prokop, Paralyzed Veterans of America; Anne Sommers, American Association of People with Disabilities; Elinor Ginzler, (AARP) American Association of Retired Persons

1. Revise as follows:

605.1.8 (Supp) <u>Accessible</u> dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2, or R-4 dwelling or sleeping units are being altered, the requirements of Section 1107 of the *International Building Code* for accessible ~~or Type A~~ units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of the spaces being altered.

2. Add new text as follows:

<u>**605.1.9 Type A dwelling or sleeping units.** Where more than 20 Group R-2 dwelling or sleeping units are being altered, the requirements of Section 1107 of the *International Building Code* for Type A units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of the spaces being altered.</u>

3. Revise as follows:

706.3 (Supp) <u>Accessible</u> dwelling units and sleeping units. Where Group I-1, I-2, I-3, R-1, R-2, or R-4 dwelling units or sleeping units are being added, the requirements of Section 1107 of the *International Building Code* for accessible units ~~or Type A~~ units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of spaces being added.

4. Add new text as follows:

<u>**706.4 Type A dwelling or sleeping units.** Where more than 20 Group R-2 dwelling or sleeping units are being added, the requirements of Section 1107 of the *International Building Code* for Type A units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of the spaces being added.</u>

<u>**706.5 Type B dwelling or sleeping units.** Where 4 or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements Section 1107 of the *International Building Code* for Type B units and Chapter 9 of the *International Building Code* for visible alarms apply only to the quantity of the spaces being added.</u>

806.1 (Supp) General. A building, facility, or element that is altered shall comply with Sections 605 and 706.

Reason: The original proponent of the code change to eliminate Type A dwelling units was concerned that the alteration of a single dwelling unit would require 2% of units to provide Type A features.

- 3409.7 requires that more than 20 units would have to be altered before 2% would have to provide Type A features.
- 3409.5.1 ensures that alterations will not require greater accessibility than that which would be required for new construction.
- IEBC 605.1 retains Type A units in alterations to residential occupancies.
- If altering an existing apartment to comply with Type A requirements has little likelihood of being accomplished because of existing conditions, the permit applicant can't take advantage of the "technically infeasible" exception in 3409.6

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

Analysis: No change is proposed to the text of Section 806.1. The section is printed for information purposes.

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

EB20–07/08
606

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

SECTION 606
STRUCTURAL

606.1 General. Where alteration work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the ~~structural~~ provisions of this section shall apply.

~~**606.2 Design criteria.** Existing structural components supporting alteration work shall comply with this section.~~

~~**606.2.1**~~ <u>**606.2**</u> **Addition or replacement of roofing or replacement of equipment.** Where addition or replacement of roofing or replacement of equipment results in additional dead loads, structural components supporting such reproofing or equipment shall comply with the ~~vertical~~ <u>gravity</u> load requirements of the *International Building Code*.

Exceptions:

1. Structural elements where the additional dead load from the roofing or equipment ~~is not increased~~ <u>does not increase the force in the element</u> by more than 5 percent.
2. Buildings constructed in accordance with the *International Residential Code* or the conventional <u>light-frame</u> construction methods of the *International Building Code* and where the ~~additional~~ dead load from the roofing or equipment is not increased by more than 5 percent.
3. Addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing, single layer of roof covering ~~shall be permitted~~.

<u>**606.3 Additional requirements for reroof permits.** The requirements of this section shall apply to alteration work requiring reroof permits.</u>

~~**606.2.2**~~ <u>**606.3.1**</u> ~~**Parapet bracing and wall anchors for reroof permits**~~ <u>**Parapets and wall anchorage in unreinforced masonry bearing wall buildings**</u>**.** Unreinforced masonry bearing wall buildings classified as Seismic Design Category D, E, or F shall have parapet bracing and wall anchors installed at the roof line whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1.

~~**606.3**~~ <u>**606.3.2**</u> **Roof diaphragm<u>s resisting wind loads</u>.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building where the roof diaphragm is a part of the main ~~windforce~~ <u>wind-force</u>-resisting system the integrity of the roof diaphragm shall be evaluated and if found deficient because of insufficient or deteriorated connections, such connections shall be provided or replaced.

Reason: This proposal is an editorial revision to improve the organization and clarity of the section.
The proposed reorganization divides the current text into 3 distinct subsections:
1. General requirements (606.1)
2. Structural requirements for Level 1 Alteration work (606.2)
3. Triggers for additional scope where required based on the scope of Level 1 Alteration work (606.3)

Additional editorial revisions are proposed for clarity and consistency with IBC terms.
This proposal improves the usability of this section and provides beneficial differentiation between Level 1 alteration work and triggers for additional scope that could be required for Level 1 alteration work.

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

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

EB21–07/08
606.2.2

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Delete and substitute as follows:

~~**606.2.2 Parapet bracing and wall anchors for reroof permits.** Unreinforced masonry bearing wall buildings classified as Seismic Design Category D, E, or F shall have parapet bracing and wall anchors installed at the roof line whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1.~~

<u>**606.2.2 Parapet bracing and wall anchors for reroofing permits.** Unreinforced masonry bearing wall buildings assigned to Seismic Design Category D, E, or F shall already have parapet bracing and wall anchors installed at the roof line as a prerequisite for a obtaining a reroofing permit for more than 25% of the building's roof area; if parapet bracing and wall anchors are not present, new parapet bracing and anchors shall be designed and installed in the area being reroofed. New parapet bracing and wall anchors shall be designed in accordance with the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1.</u>

Reason: This proposal clarifies the language in Section 606.2.2 and makes the requirements more rational. Instead of requiring installation of parapet bracing and wall anchors for all reroofing permits (even for very small repairs), the trigger is now re-roofing of more than 25% of the roof. Instead of requiring analysis of all prior parapet bracing and wall anchors to verify that they meet the requirements of the current IBC, any existing (and legal) parapet bracing and wall anchors are grandfathered to preclude owners from potentially having to upgrade their buildings every time the seismic design forces change. When only a portion of the roof is being reroofed, parapet braces and wall anchors are only required to be installed in the areas being reroofed, instead of the entire roof having to be upgraded.

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

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

EB22–07/08
606.2.2, 606.2.3 (New)

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

1. Revise as follows:

606.2.2 ~~**Parapet**~~ **Bracing** ~~**and wall anchors for reroof permits**~~ <u>**for unreinforced masonry parapets**</u>**.** ~~Unreinforced masonry bearing wall buildings classified as~~ <u>Where a permit for reproofing on a building assigned to</u> Seismic Design Category D, E, or F<u>, that has parapets constructed of unreinforced masonry, the work shall include installation of</u> ~~shall have~~ parapet bracing ~~and wall anchors installed at the roof line whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with~~ <u>to resist</u> the reduced *International Building Code* ~~level~~ seismic forces ~~as~~ specified in Section 506.1.1.3<u>, unless an evaluation demonstrates compliance of such items</u> ~~and design procedures of Section 506.1.1.1~~.

2. Add new text as follows:

<u>**606.2.3 Wall anchors for concrete and masonry buildings.** Where a permit is issued for reproofing on a building assigned to Seismic Design Category D, E, or F with a structural system consisting of concrete or reinforced masonry walls with a flexible roof diaphragm or unreinforced masonry walls with any type of roof diaphragms, the work shall include installation of wall anchors at the roof line to resist the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1, unless an evaluation demonstrates compliance of existing wall anchorage.</u>

Reason: This proposal includes the following revisions:

- Adds a 25% trigger for requiring additional upgrades, consistent with other sections of the IEBC that place reasonable limitations on the amount of work done before additional items are triggered.

- Editorially revises the current language with respect to parapet bracing and wall anchorage to require evaluation of the existing anchorage, if any, prior to adding anchorage.
- Revises the scope for parapet bracing to include unreinforced masonry parapets in all buildings, not just parapets in unreinforced masonry buildings. Many old concrete frame buildings have unreinforced masonry parapets that could pose a similar hazard as those in masonry buildings.
- Revises the scope for wall anchorage to include wall-to-roof anchors at concrete and masonry buildings with flexible diaphragms.
- Splits the current section into 2 separate sections for clarity.

Consistent with the overall approach of the IEBC, in which upgrade triggers are reasonably calibrated to the level of work, adding a stipulation that a significant portion of the roof needs to be impacted before requiring rehabilitation of the wall anchorage and parapet bracing.

Make this section consistent with the standard approach for existing buildings – first determine whether seismic deficiencies existing, then fix them if required.

Unbraced unreinforced masonry parapets can pose a significant falling hazard in any type of building, and reroofing is the appropriate time to address this potential deficiency.

Lack of wall anchorage at concrete and masonry buildings can pose as significant a risk as in unreinforced masonry buildings. To wit, the IEBC contains an appendix chapter (A2) focused on mitigating the seismic hazard associated with these buildings. Reroofing provides a good opportunity to address this potential deficiency.

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

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

EB23–07/08
606.2.2

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

606.2.2 Parapet bracing and wall anchors for ~~reroof permits~~ unreinforced masonry bearing wall buildings. Where a permit is issued for reproofing of an unreinforced masonry bearing wall ~~buildings classified as~~ building assigned to Seismic Design Category D, E, or F, the work shall include installation of ~~shall have~~ parapet bracing and wall anchors ~~installed~~ at the roof line ~~whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with~~ to resist the reduced *International Building Code* ~~level~~ seismic forces as specified in Section 506.1.1.3, unless an evaluation demonstrates compliance of such items ~~and design procedures of Section 506.1.1.1~~.

Reason: The proposed change is an editorial clarification of this section. The significant editorial change is that as currently written, the text requires parapet bracing and wall anchorage to be added regardless of whether or not it is really needed. The need for bracing and anchorage should be established first.

Consistent with the overall approach of the IEBC, in which upgrade triggers are reasonably calibrated to the level of work, adding a stipulation that a significant portion of the roof needs to be impacted before requiring rehabilitation of the wall anchorage and parapet bracing.

The other changes make this section consistent with the standard approach for existing buildings – first determine whether seismic deficiencies existing, then fix them if required.

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

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

EB24–07/08
606.3

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

Delete and substitute as follows:

~~**606.3 Roof diaphragm.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building where the roof diaphragm is a part of the main windforce-resisting system the integrity of the roof diaphragm shall be evaluated and if found deficient because of insufficient or deteriorated connections, such connections shall be provided or replaced.~~

606.3 Roof diaphragm. Where roofing materials are removed from more than 50 percent of the roof diaphragm, where the building or structure is in a Hurricane-Prone Region or Wind-Borne Debris Region, as defined by ASCE-7, and where the existing connections of the diaphragm to the main windforce-resisting system are not capable of resisting at least two-thirds of the wind loads specified in the *International Building Code*, these connections shall be repaired or strengthened so that they can withstand at least two-thirds of the wind loads specified in the *International Building Code*.

Reason: The existing wording of Section 606.3 contains significant numbers of undefined terms and is not very comprehensible. The author of this proposal was informed that the original wording may have been inserted by design professionals concerned about diaphragm-to-wall connections in structures in high-wind areas (such as hurricane regions) and has provided a proposed wording that addresses that concern and makes the wording more rational.

If it is not the case that this provision was intended to apply to high-wind areas, the phrase, “where the building or structure is in a Hurricane-Prone Region or Wind-Borne Debris Region, as defined by ASCE-7,” can be omitted.

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

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

EB25–07/08
606.3

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

606.3 Roof diaphragms in high wind regions. Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building located where the basic wind speed is greater than 90 mph or in a special wind region, as defined in Section 1609 of the *International Building Code*, ~~where the roof diaphragm is a part of the main windforce-resisting system the integrity of the roof diaphragm shall be evaluated and if found deficient because of insufficient or deteriorated connections, such connections shall be provided or replaced~~ roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition do not comply with those wind provisions, they shall be replaced or strengthened..

Reason: This proposal includes editorial revisions to clarify scope of the section, replace vague and/or unenforceable language, and clarify the wind load criteria for the roof diaphragm evaluation. In addition there is a proposed substantive change to limit the scope of this requirement to high wind regions.

The current text of this section is not clear concerning criteria for the evaluation.

Consistent with the overall approach of the IEBC, in which upgrade triggers are reasonably calibrated to the level of work, this proposal limits the scope of roof diaphragm evaluation to locations with relatively high wind loads. This is also consistent with Section 606.2.2 in which the triggers for parapet bracing are limited to areas with high seismic hazard (Seismic Design Category D-F).

Specifying areas with basic wind speed greater than 90 mph covers all Hurricane-Prone Regions as defined in the IBC (Atlantic and Gulf coasts, Hawaii, etc) as well as the high wind areas of Alaska. Including the special wind regions defined in IBC Figure 1609 captures other areas that the IBC considers at risk of high winds. The remainder of the country is exempt from this requirement, which is consistent with the intended scope of work associated with the Level 1 alterations – trigger fixes for only significant problems. Note that the IBC wind provisions for new buildings do not contain any special criteria for the tornado prone areas in the Midwest compared to other areas with the same basic wind speed of 90 mph.

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

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

EB26–07/08
606.3.1 (New), 606.3.1.1 (New), 606.3.1.2 (New), Table 606.3.1.2 (New)

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

Add new text as follows:

606.3.1 Roof decking fastening for one- and two-family dwellings. For one- and two-family dwellings, the roof deck is permitted to be fastened in accordance with Section 606.3.1.1 or 606.3.1.2 as appropriate for the existing construction. To qualify for the provisions of this section for existing nails, 8d nails shall be a minimum of 0.131 inches in diameter and a minimum 2-1/4 inches long, regardless of head shape or head diameter.

606.3.1.1 Sawn lumber or wood plank roof decking. Roof decking consisting of sawn lumber or wood planks up to 12 inches wide and secured with at least two nails (minimum size 8d) to each roof framing member it crosses shall be deemed to be sufficiently connected. Sawn lumber or wood plank decking secured with smaller fasteners than 8d nails or with fewer than two nails (minimum size 8d) to each framing member it crosses shall be deemed sufficiently connected if fasteners are added such that two clipped head, round head, or ring shank nails (minimum size 8d) are in place on each framing member it crosses.

606.3.1.2 Wood structural panel roof decking. For roof decking consisting of wood structural panels, fasteners and spacing required in columns 3 and 4 of Table 606.3.1.2 are deemed to comply with the requirements of Section 606.3 for the indicated design wind speed range. Wood structural panel connections retrofitted with a two part urethane based closed cell adhesive sprayed onto the joint between the sheathing and framing members are deemed to comply with the requirements of Section 606.3, provided testing using the manufacturer's recommended application on panels connected with 6d smooth shank nails at no more than a 6-inch edge and 12-inch field spacing demonstrates an uplift resistance of a minimum of 200 psf.

Supplemental fasteners as required by Table 606.3.1.2 shall be 8d ring shank nails with round heads and the following minimum dimensions:

1. 0.113-inch nominal shank diameter
2. Ring diameter a minimum of 0.012-inch greater than shank diameter
3. 16 to 20 rings per inch
4. a minimum 0.280-inch full round head diameter
5. 2-1/4 inch minimum nail length

TABLE 606.3.1.2
SUPPLEMENT FASTENERS AT PANEL EDGES AND INTERMEDIATE FRAMING

EXISTING FASTENERS	EXISTING FASTENER SPACING (edge or intermediate supports)	WIND SPEED 110 MPH OR LESS SUPPLEMENTAL FASTENING SHALL BE NO GREATER THAN	WIND SPEED GREATER THAN 110 MPH SUPPLEMENTAL FASTENING SHALL BE NO GREATER THAN
Staples or 6d	Any	6" o.c. [b]	6" o.c. [b]
8d clipped head or round head smooth shank	6" o.c. or less	None necessary	None necessary along edges of panels but 6" o.c. [b] at intermediate supports of panel)
8d clipped head or round head ring shank	6" o.c. or less	None necessary	None necessary
8d clipped head or round head smooth shank	Greater than 6" o.c.	6" o.c.[a]	6" o.c.[a] along edges of panel and 6" o.c.[b] at intermediate supports
8d clipped head or round head ring shank	Greater than 6" o.c.	6" o.c.[a]	6" o.c.[a]

a. Maximum spacing determined based on existing fasteners and supplemental fasteners.
b. Maximum spacing determined based on supplemental fasteners only.

Reason: The intent of this proposal is to provide a prescriptive method for compliance with Section 606.3. Section 606.3 requires the roof deck to be evaluated and remedial action when insufficient or deteriorated connections are found. However, it gives little guidance on making the required determination or providing the required corrections. Ordinarily one would to turn to the requirements for new construction. However, blindly applying the same fastening requirements where fasteners already exist could potentially compromise performance because of damage to roof panels or framing members. The assumption is that there is an optimum spacing of existing and new fasteners that is a function of the number and type of existing connectors.

Adding fasteners where fasteners already exist is different than installing fasteners in new construction because of the greater potential for damaging sheathing or framing members. To date the code only addresses nailing schedules for new installations without providing any guidance for retrofit nailing. The goal is that by the addition of additional fastener strengths will at least approach current fastening requirements in order to approach the same performance level. This code modification provides the guidance that is needed when adding fasteners where fasteners already exist.

The nail spacings shown in Table 606.3.1.2 are derived from research conducted in the 1990's at Clemson University. Smaller diameter fasteners such as staples damage framing members less than larger diameter fasteners, and subsequently yield lower strength values.

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

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

EB27–07/08
704.2.2

Proponent: Jeff Hugo, National Fire Sprinkler Association

Revise as follows:

704.2.2 (Supp) Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1, and S-2, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where all of the following conditions occur:

1. The work area is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* as applicable to new construction;
2. The work area exceeds 50 percent of the floor area; and
3. The building has sufficient municipal water supply for design of a fire sprinkler system available ~~to the floor without installation of a new fire pump~~.

Exception: Work areas in Group R occupancies three stories or less in height.

Reason: The judgment on whether to use a fire pump or not can be easily altered due to the cost and providing the space by the design professional or the building owner. A building owner and the design professional sometimes cannot see the need for a sprinkler system and by the current language have an easy way out of providing an essential life safety operation. Having a sprinkler system in an existing building will provide a higher level of safety for the occupants and fire fighters. The IEBC doesn't incorporate all the safety measures as a new building in the IBC, meaning, many of the active and passive measures are eliminated in the IEBC for architectural, structural, aesthetic, and economic reasons.

This section covers a broad range of occupancies and already provides economic relief to structures outside of a municipal water system, saving several thousands of dollars in extending a water main and/or adding water storage tanks. By giving the owner another choice to eliminate a fire sprinkler system and saving more money, could cost in lives and property down the road. The code official has to rely on the word of the owner on the necessity of a fire pump in the current language and any code official will admit the honesty of a building owner is usually left at the other side of the codes office door. The truth is by adding a fire sprinkler system will usually pay for itself in a range of 7-10+ years by insurance premium discounts, tax depreciation, business downtime in the event of a fire, and potential litigation in the event of death and injuries.

The necessity of a fire pump only comes into the equation when the hydraulic calculations are performed. In many cases pipe sizes and design will determine whether or not a fire pump is needed. For example, if a building owner has sufficient water supply at the street, but decides that he/she wants all 1 inch pipe for all four stories a fire pump would be needed. In this case water pressure is crucial and a fire pump would add the additional pressure. Anyone will tell you the owner is being unreasonable and this is the crux for removing the proposed language out of this section.

The code official needs this language out to insure the safety of lives and property in their jurisdiction and basing a life safety system solely on an economic decision is unwise. The current language is a loophole for dishonesty and a code official does not need any more of this in their day to day lives.

Cost Impact: The code change proposal will increase the cost of construction.

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

EB28–07/08
704.2.2

Proponent: Jeff Hugo, National Fire Sprinkler Association

Revise as follows:

704.2.2 (Supp) Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1, and S-2, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where all of the following conditions occur:

1. The work area is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* as applicable to new construction;
2. The work area exceeds 50 percent of the floor area; and
3. The building has sufficient municipal water supply for design of a fire sprinkler system available to the floor without installation of a new fire pump.

~~**Exception:** Work areas in Group R occupancies three stories or less in height.~~

Reason: This proposal seeks to remove Use Group R from the exception to this section for many reasons. In areas where people sleep and tend to feel the safest should not be an exception for an automatic fire sprinkler system for at least a Level 2 renovation. With most municipal water systems a three story or less building wont need a fire pump, and what other buildings are the most structurally “stacked” than the R Use to allow easy retrofitting. This exception also contradicts #1 of this section. Since the 2003 IBC, all R occupancies over two units need to be sprinkled.

R-1 occupancies typically include the transient hotels and motels. 66% of the structure fires in hotels happened in non-sprinkled hotels. There are several chain hotels that fell below the sprinkler threshold in the legacy codes and the 2000 IBC that still have several decades of service left. During their lifetime, they will undergo remodeling at some time. While paper and paint won’t trigger sprinklers in this case, other more moderate Level 2 modifications will.

R-2 occupancies typically are your dormitories, condos, non-transient hotel/motel, apartments etc. with more permanent living spaces provided in some cases. This is the group where sometimes specific age groups of our society live, i.e. college dormitories, low income apartment (HUD) housing, off campus housing, extended stay hotels/motels, etc.

From 2000 to Dec. 2006, 96 college students died from fire, 78% of these were on “off” campus housing, 11% on campus housing, 11% fraternities and sororities, and 1% in the academic portion of the college itself. The top four most common threads of college fire deaths, according to the Campus for Fire Safety, are:

1. Lack of automatic fire sprinkler systems
2. Missing or disabled smoke alarms
3. Careless disposal of smoking materials
4. Alcohol consumption

From 2000-2004, according to the NFPA, apartment fires were responsible for 7,900 fires, 30 civilian deaths, 320 civilian injuries, and $79 million dollars <u>a month</u> in damages and lives hurt and lost. From 1994-1998 only 7% of apartments were sprinkled, again, falling under the legacy codes thresholds for fire sprinklers.

It is time to catch up on probably the most easily retrofitted occupancy but by a long shot the most deadliest use group there is. Interestingly enough, whether it is an R-1, R-2 or a one & two family dwelling unit the location, time, death and injury by fire is approximately the same. Fires happen late at night or early in the morning when staffing levels are the lowest and people are sleeping, leading causes of fires are from smoking material and alcohol consumption, and the top three places to die are the kitchen, living room and the bedroom.

Cost Impact: The code change proposal will increase the cost of construction.

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

EB29–07/08
704.2.3

Proponent: Jeff Hugo, National Fire Sprinkler Association

Revise as follows:

704.2.3 (Supp) Windowless stories. Work located in a windowless story, as determined in accordance with the *International Building Code*, shall be sprinklered where the work area is required to be sprinklered under the provisions of the *International Building Code* for newly constructed buildings and the building has a sufficient municipal water supply ~~without installation of a new fire pump~~.

Reason: The judgment on whether to use a fire pump or not can be easily altered due to the cost and providing the space by the design professional or the building owner. A building owner and the design professional sometimes cannot see the need for a sprinkler system and by the current language have an easy way out of providing an essential life safety operation. Having a sprinkler system in an existing building will provide a higher level of safety for the occupants and fire fighters. The IEBC doesn’t incorporate all the safety measures as a new building in the IBC, meaning, many of the active and passive measures are eliminated in the IEBC for architectural, structural, aesthetic, and economic reasons.

This section covers a broad range of occupancies and already provides economic relief to structures outside of a municipal water system, saving several thousands of dollars in extending a water main and/or adding water storage tanks. By giving the owner another choice to eliminate a fire sprinkler system and saving more money, could cost in lives and property down the road. The code official has to rely on the word of the owner on the necessity of a fire pump in the current language and any code official will admit the honesty of a building owner is usually left at the other side of the codes office door. The truth is by adding a fire sprinkler system will usually pay for itself in a range of 7-10+ years by insurance premium discounts, tax depreciation, business downtime in the event of a fire, and potential litigation in the event of death and injuries.

The necessity of a fire pump only comes into the equation when the hydraulic calculations are performed. In many cases pipe sizes and design will determine whether or not a fire pump is needed. For example, if a building owner has sufficient water supply at the street, but decides that he/she wants all 1 inch pipe for all four stories a fire pump would be needed. In this case water pressure is crucial and a fire pump would add the additional pressure. Anyone will tell you the owner is being unreasonable and this is the crux for removing the proposed language out of this section.

The code official needs this language out to insure the safety of lives and property in their jurisdiction and basing a life safety system solely on an economic decision is unwise. The current language is a loophole for dishonesty and a code official does not need any more of this in their day to day lives.

Cost Impact: The code change proposal will increase the cost of construction.

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

EB30–07/08
704.2.4

Proponent: Jeff Hugo, National Fire Sprinkler Association

Revise as follows:

704.2.4 (Supp) Other required suppression systems. In buildings and areas listed in Table 903.2.13 of the *International Building Code*, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with sprinkler protection under the following conditions:

1. The work area is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* applicable to new construction; and
2. The building has sufficient municipal water supply for design of a fire sprinkler system available ~~to the floor without installation of a new fire pump~~.

Reason: The judgment on whether to use a fire pump or not can be easily altered due to the cost and providing the space by the design professional or the building owner. A building owner and the design professional sometimes cannot see the need for a sprinkler system and by the current language have an easy way out of providing an essential life safety operation. Having a sprinkler system in an existing building will provide a higher level of safety for the occupants and fire fighters. The IEBC doesn't incorporate all the safety measures as a new building in the IBC, meaning, many of the active and passive measures are eliminated in the IEBC for architectural, structural, aesthetic, and economic reasons.

This section covers a broad range of occupancies and already provides economic relief to structures outside of a municipal water system, saving several thousands of dollars in extending a water main and/or adding water storage tanks. By giving the owner another choice to eliminate a fire sprinkler system and saving more money, could cost in lives and property down the road. The code official has to rely on the word of the owner on the necessity of a fire pump in the current language and any code official will admit the honesty of a building owner is usually left at the other side of the codes office door. The truth is by adding a fire sprinkler system will usually pay for itself in a range of 7-10+ years by insurance premium discounts, tax depreciation, business downtime in the event of a fire, and potential litigation in the event of death and injuries.

The necessity of a fire pump only comes into the equation when the hydraulic calculations are performed. In many cases pipe sizes and design will determine whether or not a fire pump is needed. For example, if a building owner has sufficient water supply at the street, but decides that he/she wants all 1 inch pipe for all four stories a fire pump would be needed. In this case water pressure is crucial and a fire pump would add the additional pressure. Anyone will tell you the owner is being unreasonable and this is the crux for removing the proposed language out of this section.

The code official needs this language out to insure the safety of lives and property in their jurisdiction and basing a life safety system solely on an economic decision is unwise. The current language is a loophole for dishonesty and a code official does not need any more of this in their day to day lives.

Cost Impact: The code change proposal will increase the cost of construction.

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

EB31–07/08
704.4

Proponent: Daniel E. Nichols P.E., New York State Division of Code Enforcement and Administration, Albany, NY

1. Revise as follows:

704.4 Fire alarm and detection. An approved fire alarm system shall be installed in accordance with Sections 704.4.1 through 704.4.3. ~~Where automatic sprinkler protection is provided in accordance with Section 704.2 and is connected to the building fire alarm system, automatic heat detection shall not be required.~~

~~An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA 72. Devices, combinations of devices, appliances, and equipment shall be approved. The automatic fire detectors shall be smoke detectors, except that an approved alternative type of detector shall be installed in spaces such as boiler rooms, where products of combustion are present during normal operation in sufficient quantity to actuate a smoke detector.~~

704.4.1 Occupancy requirements. A fire alarm system shall be installed in work areas in accordance with Section~~s~~ ~~704.4.1.1 through 704.4.1.7~~ 907 of the *International Building Code* for new buildings. Existing alarm-notification appliances shall be automatically activated throughout the building. Where the building is not equipped with a fire alarm system, alarm-notification appliances within the work area shall be provided and automatically activated.

Exception~~s~~: ~~1.~~ Occupancies with an existing, previously approved fire alarm system. ~~2. Where selective notification is permitted, alarm-notification appliances shall be automatically activated in the areas selected.~~

2. Delete without substitution:

~~**704.4.1.1 Group E.**~~
~~**704.4.1.2 Group I-1.**~~
~~**704.4.1.3 Group I-2.**~~
~~**704.4.1.4 Group I-3.**~~
~~**704.4.1.5 Group R-1.**~~
~~**704.4.1.6 Group R-2.**~~
~~**704.4.1.7 Group R-4.**~~

3. Revise as follows:

704.4.2 Supplemental fire alarm system requirements. Where the work area on any floor exceeds 50 percent of that floor area, Section 704.4.1 shall apply throughout the floor.

> **Exception:** Alarm-initiating and notification appliances shall not be required to be installed in tenant spaces outside of the work area.

704.4.3 Smoke alarms. Individual sleeping units and individual dwelling units in any work area in Group R-1, R-2, R-3, R-4, and I-1 occupancies shall be provided with smoke alarms in accordance with the *International Fire Code*.

> ~~**Exception:** Interconnection of smoke alarms outside of the rehabilitation work area shall not be required.~~

Reason: This code section fixes a technical flaw between the International Fire Code and the International Existing Building Code. Currently, the International Existing Building Code allows for the retroactive requirements of the International Fire Code to be limited by isolating such requirements to work areas only. The structure of the International Fire Code is that the retroactive requirements applies to all buildings, not those being worked on. However, the IEBC does just that, and actually lowers the level of building fire protection than if the building was just enforced to the level of the IFC.

As an example, IFC Section 907.3.1.1 requires a majority of existing Group E occupancies to be provided with a fire alarm system. IEBC Section 704.4.1.1 limits the requirement to just the work area within a Group E even though more construction work is being done in the latter condition.

The code change changes the reference to the new construction requirements for fire alarm requirements. To do so, the occupancy requirements have been directed to the IBC for new construction, a more appropriate requirement for fire alarm coverage. By referencing the new construction requirements, it adds other occupancies to the Alterations-Level 2 section, including Group A occupancies.

The remainder of the code change is mostly editorial. First, most of Section 704.4 is being removed to align with the new layout of Section 907, as approved in the 2007 supplement. Second, exception #2 of Section 704.4.1 was removed since IBC Section 907 already sets requirements for selective notification. Third, the exception of Section 704.4.3 has been removed since the retroactive smoke alarm requirements of the IFC already have requirements dealing with interconnect in existing buildings. Section 704.4.2 is shown for informational purposes only.

Cost Impact: The code change proposal will increase the cost of construction.

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

EB32–07/08
706.2

Proponent: Scott Crossfield, Theatre Projects Consultants, Inc.

Revise as follows:

706.2 Stairs and escalators in existing buildings. In alterations<u>, change of occupancy or additions</u> where an escalator or stair is added where none existed previously <u>and major structural modifications are necessary for installation</u>, an accessible route shall be provided <u>between the levels served by the escalator or stairs</u> in accordance with Sections 1104.4 and 1104.5 of the *International Building Code*.

Reason: G208-06/07 Part I, revised the same language in Chapter 34 of the IBC and Chapter 3 of the IEBC to clarify when an accessible route is required between levels in the situation when a stairway or escalator is added. This should be repeated in Section 706.2 for internal consistency and consistency with federal requirements. The proposed language would coordinate with ADA 206.2.3.1. The ADAAG approach seems more reasonable for when an elevator or platform lift would be required.

> **PART II — IEBC**
> **Committee Action: Disapproved**

Committee Reason: The committee indicated that providing requirements for change of occupancy and additions in the alterations chapter would be confusing to the code user. These proposed requirements would be more appropriately located in the chapters dealing with additions and change of occupancy. Additionally, the reason statement indicates coordination with portions of ADA; however, it does not appear that all of those portions are part of this change.

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

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

EB33–07/08
707, 807

Proponent: Peter Somers, S.E., Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

SECTION 707
STRUCTURAL

707.1 General. ~~Where alteration work includes installation of additional equipment that is structurally supported by the building or reconfiguration of space such that portions of the building become subjected to higher gravity loads as required by Tables 1607.1 and 1607.6 of the *International Building Code*, the provisions of this section shall apply.~~ Structural elements and systems within buildings undergoing Level 2 Alterations shall comply with this section.

~~**707.2 Reduction of strength.** Alterations shall not reduce the structural strength or stability of the building, structure, or any individual member thereof.~~

~~**Exception:** Such reduction shall be allowed as long as the strength and the stability of the building are not reduced to below the *International Building Code* levels.~~

~~**707.3**~~ **707.2 New structural ~~members~~ elements.** New structural ~~members~~ elements in alterations, including connections and anchorage, shall comply with the *International Building Code*.

~~**807.4**~~ **707.3 Minimum design loads.** The minimum design loads on existing elements of a structure that do not support additional loads as a result of an alteration shall be the loads applicable at the time the building was constructed.

707.4 Existing structural ~~members~~ elements carrying gravity loads. ~~Existing structural components supporting additional equipment or subjected to additional loads based on *International Building Code* Tables 1607.1 and 1607.6 as a result of a reconfiguration of spaces shall comply with Sections 707.4.1 through 707.4.3.~~ Alterations shall not reduce the capacity of existing gravity load-carrying structural elements unless it is demonstrated that the elements have the capacity to resist the applicable design gravity loads required the *International Building* Code. ~~**707.4.1 Gravity loads.**~~ Existing structural elements supporting any additional gravity loads as a result of ~~additional equipment or space reconfiguration~~ the alterations, including the effects of snow drift, shall comply with the *International Building Code*.

Exceptions:

1. Structural elements whose stress is not increased by more than 5 percent.
2. Buildings of Group R occupancy with not more than five dwelling units or sleeping units used solely for residential purposes where the existing building and its alteration comply with the conventional light- frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.

~~**707.4.2**~~ **707.5 Existing structural elements resisting lateral loads.** ~~Buildings in which Level 2 alterations increase the seismic base shear by more than 10 percent or decrease the seismic base shear capacity by more than 10 percent~~ Any existing lateral load-resisting structural element whose demand-capacity ratio with the alteration considered is more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall comply with the structural requirements specified in ~~Sections 807.5 and 807.7~~ Section 807.4. ~~Changes in base shear and base shear capacity shall be calculated relative to conditions at the time of the original construction.~~ For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces ~~per~~ in accordance with Sections 1609 and 1613 of the *International Building Code*. For purposes of this section, comparisons of demand-capacity ratios and calculation of design lateral loads, forces, and capacities shall account for the cumulative effects of additions and alterations since original construction.

> ~~**Exception:** If the building's seismic base shear capacity has been increased since the original construction, the percentage changes shall be permitted to be calculated relative to the increased value.~~

~~**707.4.3 Snow drift loads.** Any structural element of an existing building subjected to additional loads from the effects of snowdrift as a result of additional equipment shall comply with the *International Building Code*.~~

~~**Exceptions:**~~

1. ~~Structural elements whose stress is not increased by more than 5 percent.~~
2. ~~Buildings of Group R occupancy with no more than five dwelling units or sleeping units used solely for residential purposes where the existing building and its alteration comply with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.~~

~~807.7~~ 707.6 Voluntary lateral-force-resisting system alterations. Alterations of existing structural elements and additions of new structural elements that are initiated for the purpose of increasing the lateral-force-resisting strength or stiffness of an existing structure and that are not required by other sections of this code shall not be required to be designed for forces conforming to the *International Building Code,* provided that an engineering analysis is submitted to show that:

1. The capacity of existing structural elements required to resist forces is not reduced;
2. Either the lateral loading to existing structural elements is not increased beyond their capacity or the lateral loading to existing structural elements is not increased by more than 10 percent;
3. New structural elements are detailed and connected to the existing structural elements as required by the *International Building Code*;
4. New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required by the *International Building Code*; and
5. A dangerous condition as defined in this code is not created.
Voluntary alterations to lateral-force-resisting systems conducted in accordance with Appendix A and the referenced standards of this code shall be permitted.

SECTION 807
STRUCTURAL

807.1 General. Where buildings are undergoing Level 3 alterations including structural alterations, the provisions of this section shall apply.

~~**807.2 Reduction of strength.** Alterations shall not reduce the structural strength or stability of the building, structure, or any individual member thereof.~~

> ~~**Exception:** Such reduction shall be allowed provided that the structural strength and the stability of the building are not reduced to below the *International Building Code* levels.~~

~~807.3~~ 807.2 New structural-elements ~~members~~. New structural ~~members in alterations, including connections and anchorage, shall comply with the *International Building Code*~~ elements shall comply with Section 707.2*.*

807.3 Existing structural elements carrying gravity loads. Existing structural elements carrying gravity loads shall comply with Section 707.4.

~~807.5~~ 807.4 Structural alterations. All structural elements of the lateral-force resisting system in buildings ~~and structures~~ undergoing Level 3 structural alterations or buildings ~~in which the seismic base shear is increased by more than 10 percent or in which the seismic base shear capacity is decreased by more than 10 percent because of alterations~~ undergoing Level 2 alterations as triggered by Section 707.5 shall comply with this section. ~~Changes in base shear and base shear capacity shall be calculated relative to conditions at the time of the original construction.~~

Exceptions:

1. Buildings of Group R occupancy with no more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *International Building Code* or in compliance with the provisions of the *International Residential Code.*

2. Where such alterations involve only the lowest story of a building and the change of occupancy provisions of Chapter 9 do not apply, only the lateral-force-resisting components in and below that story need comply with this section.
3. ~~If the building's seismic base shear capacity has been increased since the original construction, the percentage changes shall be permitted to be calculated relative to the increased value.~~

~~**807.5.1**~~ <u>**807.4.1**</u> **Evaluation and analysis.** An engineering evaluation and analysis that establishes the structural adequacy of the altered structure shall be prepared by a registered design professional and submitted to the code official.

~~**807.5.2**~~ <u>**807.4.2**</u> **Substantial structural alteration.** Where more than 30 percent of the total floor and roof areas of the building or structure have been or are proposed to be involved in structural alteration within a 12-month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the *International Building Code* for wind loading and with reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 for seismic loading. For seismic considerations, the analysis shall be based on one of the procedures specified in Section 506.1.1.1. The areas to be counted toward the 30 percent shall be those areas tributary to the vertical load-carrying components, such as joists, beams, columns, walls and other structural components that have been or will be removed, added or altered, as well as areas such as mezzanines, penthouses, roof structures and in-filled courts and shafts.

~~**807.5.3**~~ <u>**807.4.3**</u> **Limited structural alteration.** Where not more than 30 percent of the total floor and roof areas of the building are involved in structural alteration within a 12-month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads applicable at the time of the original construction or of the most recent substantial structural alteration as defined by Section ~~807.5.2~~ <u>807.4.2</u>. <u>Any existing structural element whose seismic demand-capacity ratio with the alteration considered is more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall comply with the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3.</u>

~~**807.6 Additional vertical loads.** Where gravity loading is increased on the roof or floor of a building or structure, all structural members affected by such increase shall meet the gravity load requirements of the *International Building Code*.~~

~~**Exceptions:**~~

1. ~~Structural elements whose stress is not increased by more than 5 percent.~~
2. ~~Buildings of Group R occupancy with no more than five dwelling units or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *International Building Code* or in compliance with the provisions of the *International Residential Code*.~~

Reason: This proposal is intended to remove some conflicts, fix some gaps in scoping, and remove redundant text in the current text of Sections 707 and 807. In addition, there are some editorial revisions for clarity, useability, and flow. Two of the provisions currently applied to Level 3 alterations are moved to Level 2 alterations so that they apply to both sections. Those revisions do not expand the scope of Level 2 alterations, but instead provide more clarity and flexibility for Level 2 alterations.

The following is a section-by-section summary of the proposed revisions. Except where noted, the section numbers reference the current text.

Section 707.1: The description of work in the current Section 707.1 is either repeating the definition of Level 2 alterations or is limiting the scope of this section to just a specific type of work within Level 2 alterations. In either case, these descriptions are not necessary. Instead, Section 707 should apply to all structural work or impacts to structural systems associated with Level 2 alterations.

Section 707.2: The current section is in direct conflict with Section 707.4.2 which does permit a reduction of strength for elements resisting lateral loads. This proposal eliminates the conflict and combines the current section with Section 707.4 for better clarity.

Section 707.3: No change to this section, except that it is renumbered and editorially, "member" is changed to "element" consistent throughout Sections 707 and 807.

Section 707.4: The current text seems to erroneously limit the scope of this section. There are types of Level 2 alterations that could increase the load on existing elements besides adding equipment or revising live loads. In addition, based on the scope of this section, Section 707.4.2 would never technically be triggered since the text Section 707.4 doesn't refer to any lateral load revisions. This proposal fixes these problems and slightly revises the organization of the Section 707.4 and its subsections. The current specific text related to IBC loading criteria is replaced by a general reference to the IBC for gravity loads.

Section 707.4.1: This section is combined with 707.4, but there are no substantive changes. The added text referring to snow drift loads comes from current section 707.4.3, which is proposed to be deleted, since snow drift loads are gravity loads.

Section 707.4.2: This section is separated from 707.4 and made new section 707.5 to better distinguish the requirements for gravity and lateral loads. A substantive change is proposed to eliminate a loophole in the current Section 707.4.2 by which a 9% increase in load would be allowed even with a simultaneous 9% decrease in capacity, the provision is written in terms of demand-capacity ratio to reflect the actual intent of a trigger based on 10% total change. In addition, the referencing for loads and load combinations is improved, and the current text in the Exception to this section is recast for clarity.

Section 707.4.3: This section is essentially identical to current Section 707.4.1 except that "gravity" is replaced with "snow drift". The requirements of this section are technically covered under current Section 707.4.1 since snow drift is a gravity load. This proposal adds a reminder for snow drift loads in Section 707.4.

Section 807.1: This proposal adds a reminder reference to sections 607 and 707 for structural requirements triggered by Section 801.2. This reminder should not be necessary given the requirement in Section 405.2, but may be helpful to the user

Section 807.2: Section deleted for the same conflicted noted in current Section 707.2 and since the provisions (revised per discussion of current Section 707.2) are included in the revised Section 707.4 for Level 2 alterations, which applies to Level 3 alterations per Section 405.2 and revised Section 807.1.

Section 807.3: As an editorial revision to simplify the text, the current text is replaced with a reference to the identical provision in Section 707.2.

Section 807.4: Section moved from Level 3 alterations to Chapter 7 for Level 2 alterations since the provision should apply to either levels of work.

Section 807.5: Section is renumbered. This section applies in two separate conditions: (1) All buildings subject to Level 3 alterations and (2) where triggered by buildings undergoing level 2 alterations in which the seismic base shear demand is increased by 10 percent or decreased by 10 percent. (Note the word "or" in the text separating the two clauses in the current text.) In order to clarify that the revisions in seismic demand or capacity only apply to Level 2 alterations, this text is deleted and replaced with a reference to the triggers in revised Section 707.5. The last sentence of the main text and Exception 3 apply only to Level 2 alterations and are contained in Section 707.5, so it they are deleted here.

Section 807.5.1: No revisions to this section, except that it is renumbered.

Section 807.5.2: Fix an incorrect section reference; otherwise no revisions except for renumbering.

Section 807.5.3: As currently written, current Section 807.5.3 would allow the reduction in capacity or increase in seismic forces in components as long as the altered building complies with the code in effect at the time or original construction. It is common that buildings were constructed prior to seismic codes, so it is possible (in the extreme) that all of the capacity could be eliminated. The intent of the rewritten section is to make sure that the altered elements at least satisfy the reduced IBC level seismic forces of Section 506.1.1.3. This provision applies only to the altered element, not the entire building as required for substantial structural alterations per revised Section 807.4.2, and is consistent with the seismic provisions of Section 707.5 for Level 2 alterations, which based on Section 405.2 should be the minimum baseline for Level 3 alterations.

Section 807.6: Section deleted since the provisions are adequately covered by Chapter 7 for Level 2 alterations. Based on Section 405.2 and revised Section 807.1, this section is redundant.

Section 807.7: Section moved to Chapter 7 for Level 2 alterations since it is possible that a voluntary seismic upgrade could be considered a Level 2 alteration. By placing the provision in Chapter 7, it applies to both Level 2 and Level 3 alterations, and provides more flexibility in considering voluntary seismic upgrades that could be less than the scoping for Level 3 alterations.

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

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

EB34–07/08
807.5.1

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

807.5.1 Evaluation and analysis. An engineering evaluation and analysis that establishes the structural adequacy of the altered structure shall be prepared by a registered design professional and submitted to the code official. For structures assigned to Seismic Design Category D, E, or F, the registered design professional shall submit to the code official a seismic evaluation report summarizing the altered building's seismic performance relative to the reduced *International Building Code* level seismic forces specified in Section 506.1.1.3. This seismic evaluation report shall not be required for buildings in compliance with the benchmark building provisions of ASCE 31, Section 3.2.

Reason: To make building owners aware of potential seismic deficiencies in older buildings located in regions of high seismic hazard where substantial renovation work is being performed.

In very few cases would the 2006 IEBC require seismic upgrades of older, nonconforming buildings undergoing major renovations that do not affect the structure itself. While not adding any requirements for seismic retrofits, this revision would at minimum require a seismic evaluation report in conjunction with a Level 3 alteration.

The report is non-binding, but would alert building owners of the seismic deficiencies in their buildings that they may choose to mitigate during the alteration. The requirement is limited to the high seismic regions, and would be waived for newer buildings designed to modern seismic codes (ASCE 31 benchmark buildings).

We also note that several local jurisdictions (for example Seattle, Washington and Portland, Oregon) have similar evaluation report requirements for buildings undergoing substantial alterations.

Cost Impact: The code change proposal will increase the cost of construction. Requires engineering report for some buildings undergoing substantial alterations, but no construction cost impact.

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

EB35–07/08
907.3.1, 907.3.2

Proponent: Peter Somers, S.E., Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

907.3.1 Compliance with the *International Building Code* level seismic forces. ~~When~~ Where a building or portion thereof is subject to a change of occupancy ~~such~~ that ~~a change in the nature of the occupancy~~ results in the building being assigned to a higher ~~seismic occupancy factor~~ occupancy category based on Table 1604.5 of the *International Building Code*; or where such change of occupancy results in a reclassification of a building to a higher hazard category as shown in Table 912.4; or where a change of a Group M occupancy to a Group A, E, I-1 R-1, R-2 or R-4 occupancy with two-thirds or more of the floors involved in Level 3 alteration work, the building shall ~~conform to the seismic requirements of the *International Building Code* for the new seismic use group~~ comply with the requirements for *International Building Code* level seismic forces as specified in Section 506.1.1.2 for the new occupancy category.

Exceptions:

1. Group M occupancies being changed to Group A, E, I-1, R-1, R-2 or R-4 occupancies for buildings less than six stories in height and in Seismic Design Category A, B or C.
2. Where approved by the code official, specific detailing provisions required for a new structure are not required to be met where it can be shown that an ~~acceptable~~ equivalent level of performance and seismic safety is obtained for the applicable ~~seismic use group using~~ occupancy category based on the provision for reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3. ~~The rehabilitation procedures shall be approved by the code official and shall consider the regularity, overstrength, redundancy and ductility of the lateral-load-resisting system within the context of the existing detailing of the system.~~
3. Where the area of the new occupancy with a higher hazard category is less than or equal to 10 percent of the total building floor area and the new occupancy is not classified as ~~Seismic Use Group~~ occupancy category IV. For the purposes of this exception, ~~where a structure is~~ buildings occupied ~~for~~ by two or more occupancies not included in the same ~~seismic use group~~ occupancy category, ~~the structure shall be assigned the classification of the highest seismic use group corresponding to the various occupancies. Where structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a structurally separated portion of a structure provides required access to, required egress from or shares life safety components with another portion having a higher seismic use group, both portions shall be assigned the higher seismic use group~~ shall be subject to the provisions of Section 1604.5.1 of the *International Building Code*. The cumulative effect of the area of occupancy changes shall be considered for the purposes of this exception.
4. Unreinforced masonry bearing wall buildings in Occupancy Category III when assigned to Seismic Design Category A or B shall be allowed to be strengthened to meet the requirements of Appendix Chapter A1 of this code [*Guidelines for the Seismic Retrofit of Existing Buildings* (GSREB)].

907.3.2 Access to ~~Seismic Use Group~~ occupancy category IV. Where ~~the~~ a change of occupancy is such that compliance with Section 907.3.1 is required and the ~~seismic use group is a~~ building is assigned to occupancy category IV, the operational access to ~~such Seismic Use Group IV existing structure~~ the building shall not be through an adjacent structure, unless than ~~**Exception:** Where the adjacent~~ structure conforms to the requirements for ~~Seismic Use Group~~ occupancy category IV structures. Where operational access is less than 10 feet (3048 mm) from an interior lot line or less than 10 feet (3048 mm) from another structure, access protection from potential falling debris shall be provided by the owner of the ~~Seismic Use Group~~ occupancy category IV structure.

Reason: This proposed revision is primarily editorial, making the section consistent with current IBC terminology. A substantive change involves permitting ASCE 41, as referenced in Section 506.1.1.2, as an alternate to the IBC for the seismic evaluation and design.

The editorial revision to the main text of Section 907.3.1 clarifies language consistent with term used in the IBC. A proposed substantive revision to this section adds reference to 506.1.1.2 for the evaluation and design procedures related to full IBC level seismic forces. Section 506.1.1.2 permits the use of ASCE 41 as an alternate to the IBC, for seismic evaluation and design for repairs and alternations. The ASCE 41 scoping in Section 506.1.1.2 is intended to provide seismic performance that is roughly equivalent to the IBC and, unlike the IBC, it is intended specifically for existing buildings that may not satisfy all the detailing provisions of the IBC.

The revisions to Exception 2 are editorial to improve the clarity of the section. The last sentence of this section is removed since the requirements for regularity, overstrength, redundancy, ductility are addressed specifically in the various evaluation and design methods contained in Section 506.1.1.3 and need not be repeated here. Furthermore, each of the methods have different ways of considering those requirements, so that the terms used in this section may not necessarily apply.

The revisions to Exception 3 are editorial to remove outdated terms. Most of the stricken text is identical to IBC Section 1604.5.1, concerning buildings with multiple occupancy categories, so the text is replaced with a reference to that section.

The revisions to Section 907.3.2 are editorial to remove outdated terms and to simplify the section.

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

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

EB36–07/08
912.6.1

Proponent: William W. Stewart, Architect, Chesterfield, MO, representing himself

Revise as follows:

912.6.1 Exterior wall rating for change of occupancy classification to a higher hazard category. When a change of occupancy classification is made to a higher hazard category as shown in Table 912.6, exterior walls shall have fire resistance and exterior opening protectives as required by the *International Building Code*. ~~This provision shall not apply to walls at right angles to the property line.~~

> **Exception:** A 2-hour fire-resistance rating shall be allowed where the building does not exceed three stories in height and is classified as one of the following groups: A-2 and A-3 with an occupant load of less than 300, B, F, M, or S.

Reason: The deleted sentence was necessary when there was confusion how to measure the distance from the building to the property line or the distance from the property line to the building. That confusion went away with the revised definition of Fire Separation Distance in the 2006 Building Code. Thus the deleted sentence is no longer necessary. This change makes no technical change to the IEBC.

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

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

EB37–07/08
912.8.2

Proponent: Dominic Marinelli, United Spinal Association

Revise as follows:

912.8 Accessibility. Existing buildings that undergo a change of group or occupancy classification shall comply with this section.

912.8.1 Partial change in occupancy. Where a portion of the building is changed to a new occupancy classification, any alterations shall comply with Sections 605 and 706 as applicable.

912.8.2 (Supp) Complete change of occupancy. Where an entire building undergoes a change of occupancy, it shall comply with Section 912.8.1 and shall have all of the following accessible features:

1. At least one accessible building entrance.
2. At least one accessible route from an accessible building entrance to primary function areas.
3. Signage complying with Section 1110 of the *International Building Code*.
4. Accessible parking, where parking is provided.
5. At least one accessible passenger loading zone, where loading zones are provided.
6. At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.

Where it is technically infeasible to comply with the new construction standards for any of these requirements for a change of group or occupancy, the above items shall conform to the requirements to the maximum extent technically feasible.

~~**Exception:** Type B dwelling or sleeping units required by Section 1107 of the *International Building Code* are not required to be provided in existing buildings and facilities.~~

Reason: The intent of this proposal is to make the Type B dwelling unit requirements required in a building that undergoes a change of occupancy. While the Fair Housing Act only addresses new construction, the building codes historically have required buildings that change from one use to another to comply with the requirements for the new use. What could be the technical justification that would prohibit a warehouse being converted into apartments from providing the minimal accessibility requirements in Type B units? The same exceptions in Section 1107.7 would apply as for new construction, therefore Type B units would not be required in changes of occupancy with fewer than 4 units, in upper floors of non-elevator buildings, etc. These types of units are in greater need as the average population of America ages.

This same change of occupancy would be expected to provide Type A units if it contained more than 20 units. Why is the justification for the codes being inconsistent in their approach dealing with providing homes that can be used for a persons lifetime?

United Spinal has similar changes in for IBC Chapter 34 and IEBC Chapter 3 where they are requesting the elimination of the Type B exception for existing buildings. This revision would also be consistent for partial changes of occupancy in 2007 Supplement Section 912.8.1. United Spinal has proposed a change to Section 706 (referenced in Section 912.8.1) to required Type B units when 4 or more units are added.

Cost Impact: This code change proposal will increase the cost of construction.

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

EB38–07/08
1003.3.1, 1003.3.2

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

1003.3.1 Vertical addition. Any element of the lateral-force-resisting system of an existing building subjected to an increase in vertical or lateral loads from the vertical addition shall comply with the ~~lateral load provisions of the~~ *International Building Code* wind provisions and the *International Building Code* level seismic forces specified in Section 506.1.1.2.

1003.3.2 Horizontal addition. Where horizontal additions are structurally connected to an existing structure, all lateral-force-resisting elements of the existing structure affected by such addition shall comply with the ~~lateral load provisions of the~~ *International Building Code* wind provisions and the *International Building Code* level seismic forces specified in Section 506.1.1.2.

Reason: Editorial clarification to permit the use of ASCE 41 for additions by means of the reference to Section 506.1.1.2, which provides scoping language for using the IBC and ASCE 41 for seismic evaluation and design. This proposal provides alternative options for compliance, consistent with the overall goal of the IEBC. The requirements for wind are unchanged from the current text – wind is only specified to differentiate it from seismic.

The IEBC considers ASCE 41 with the BSE-1 and BSE-2 earthquake hazard levels equivalent to the IBC based on the scoping language in Section 506.1.1.2, therefore ASCE 41, which is intended for existing buildings, should be permitted to be used for the evaluation and design of buildings with additions. ASCE 41 is better suited for existing buildings, providing acceptance criteria for elements and systems that do not necessarily meet the seismic detailing requirements in the IBC and ASCE 7 but are expected to provide acceptable seismic performance.

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

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

EB39–07/08
1005.1, 1104.1

Proponent: Dominic Marinelli, United Spinal Association

Revise as follows:

1005.1 Minimum requirements. Accessibility provisions for new construction shall apply to additions. An addition that affects the accessibility to, or contains an area of, primary function shall comply with the requirements of Sections 605 and 706.

1104.1 Accessibility requirements. The provisions of Section<u>s</u> 605 <u>and 706 as applicable</u> shall apply to buildings and facilities designated as historic structures that undergo alterations, unless technically infeasible. Where compliance with the requirements for accessible routes, entrances, or toilet facilities would threaten or destroy the historic significance of the building or facility, as determined by the code official, the alternative requirements of Sections 1104.1.1 through 1104.1.4 for that element shall be permitted.

Reason: The intent of this proposal is to address an inconsistency in accessibility requirements for additions (Chapter 10) and historical buildings (Chapter 11). While most of the accessibility provisions are located in Section 605 under Level I alterations, there are some accessibility provisions in Section 706 under Level II alterations when elements are added. While the scoping provisions in Chapter 4 do have a cumulative effect for Level I, II and III alterations, this same information is not applicable to additions and alterations, therefore the reference is needed.

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

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

EB40–07/08
1101.2

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Revise as follows:

1101.2 Report. A historic building undergoing repair, alteration, or change of occupancy shall be investigated and evaluated. If it is intended that the building meet the requirements of this chapter, a written report shall be prepared and filed with the code official by a registered design professional when such a report is necessary in the opinion of the code official. Such report shall be in accordance with Chapter 1 and shall identify each required safety feature that is in compliance with this chapter and where compliance with other chapters of these provisions would be damaging to the contributing historic features. ~~In high seismic zones~~ <u>For buildings assigned to Seismic Design Category D, E or F</u>, a structural evaluation describing, at minimum, a complete load path and other earthquake-resistant features shall be prepared. In addition, the report shall describe each feature that is not in compliance with these provisions and shall demonstrate how the intent of these provisions is complied with in providing an equivalent level of safety.

Reason: Editorial clarification for language consistent with the IBC.

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

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

EB41–07/08
1101.2

Proponent: Maureen Traxler, City of Seattle, WA, representing Department of Planning & Development

Revise as follows:

1101.2 Report. A historic building undergoing repair, alteration, or change of occupancy shall be investigated and evaluated. If it is intended that the building meet the requirements of this chapter, a written report shall be prepared and filed with the code official by a registered design professional when such a report is necessary in the opinion of the code official. Such report shall be in accordance with Chapter 1 and shall identify each required safety feature that is in compliance with this chapter and where compliance with other chapters of these provisions would be damaging to the contributing historic features. In ~~high seismic zones~~ <u>Seismic Design Categories C, D, E and F</u>, a structural evaluation describing, at minimum, a complete load path and other earthquake-resistant features shall be prepared. In addition, the report shall describe each feature that is not in compliance with these provisions and shall demonstrate how the intent of these provisions is complied with in providing an equivalent level of safety.

Reason: The term “high seismic zones” is not defined, making it impossible to know which geographic areas are subject to the requirement. Seismic Design Category is the appropriate term because it is used throughout the IEBC and IBC to distinguish levels of seismic risk. The question is whether SDC C should be included as a “high seismic zone”. We include it here because preparation of a report is a very useful tool for evaluating the condition of a building, and is not extremely onerous.

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

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

EB42–07/08
1102.2, 1102.4

Proponent: Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

1. Revise as follows:

1102.2 Dangerous buildings. When a historic building is determined to be ~~dangerous~~ unsafe, ~~no work shall be required except as necessary to correct identified unsafe conditions~~ only the unsafe conditions need be corrected or mitigated.

2. Delete without substitution:

~~**1102.4 Chapter 5 compliance.** Historic buildings undergoing repairs shall comply with all of the applicable requirements of Chapter 5, except as specifically permitted in this chapter.~~

Reason: This proposal attempts to clarify the requirements of Chapter 11 with respect to repairs to historic buildings.

Section 1102.2 used the terms “dangerous” and “unsafe” interchangeably, but the two terms have different definitions. This proposal clarifies the requirement.

Section 1102.4 references the requirements of Chapter 5, but this requirement is completely superseded by the wording in Section 1102.1, which states that repairs to any portion of a historic building or structure shall be permitted with original or like materials and original methods of construction, subject to the provisions of Chapter 11. Consequently, it makes sense to delete Section 1102.4; otherwise the reference is circular and nonsensical.

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

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

EB43–07/08
1103.8

Proponent: Maureen Traxler, City of Seattle, WA, representing Department of Planning & Development

Revise as follows:

1103.8 Glazing in fire-resistance-rated systems. Historic glazing materials shall be permitted in interior walls required to have a 1-hour fire-resistance rating ~~may be permitted when~~ where the opening is provided with approved smoke seals and ~~when~~ the area affected is provided with an automatic sprinkler system.

Reason: This is an editorial revision of Section 1103.8. It is not intended to alter the meaning; merely to make it more clear.

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

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

EB44–07/08
202 (New), 410 (New), 1301 (New), 1302 (New), 1303 (New), 1304 (New)

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

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

RETROFIT. The voluntary process of strengthening or improving buildings or structures, or individual components of buildings or structures, with the purpose of making existing conditions better serve the purpose for which they were originally intended or the purpose that current building codes intend.

CHAPTER 4
CLASSIFICATION OF WORK

SECTION 410
RETROFITTING

410.1 Scope. Retrofitting of buildings, as defined in Chapter 2, includes work of a voluntary nature for the purpose of improving the ability of the building or building elements or building components serve the purpose for which they were originally intended or the purpose that current building codes intend. Retrofit work shall not include repair work as defined in Chapter 2 and described in Section 402.1.

410.2 Application. Retrofitting of existing buildings shall comply with the provisions of Chapter 13.

CHAPTER 13
RETROFITTING

SECTION 1301
GENERAL

1301.1 Intent and purpose. The provisions of this subsection provide prescriptive solutions for the retrofitting of buildings. The retrofit measures are intended to provide strengthening of buildings such that the retrofitted measures have strength equal to the structural provisions of the latest building code requirements for new buildings. Design for compliance of new buildings and additions to existing buildings shall conform to the requirements of the *International Building Code* or *International Residential Code* as applicable.

1301.2 Scope. Retrofit work as described in Section 410.1 shall comply with the requirements of this chapter.

SECTION 1302
DEFINITIONS

ANCHOR BLOCK. A nominal 2-inch thick by at least 4” wide piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

COMPRESSION BLOCK. A nominal 2-inch thick by at least 4” wide piece of lumber used to restrain in the compression mode (force directed towards the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

CONVENTIONALLY FRAMED GABLE END. A conventionally framed gable end with studs whose faces are perpendicular to the gable end wall.

HORIZONTAL BRACE. A nominal 2-inch thick by at least 4” wide piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

RETROFIT STUD. A nominal 2-inch lumber member used to structurally supplement an existing gable end wall stud.

RIGHT ANGLE BRACKET. A 14 gage or thicker metal right angle bracket with a minimum load capacity perpendicular to the plane of either face of 350 lbs when connected to wood or concrete with manufacturer specified connectors.

STUD-TO-PLATE CONNECTOR. A manufactured metal connector designed to connect studs to plates with a minimum uplift capacity of 500 lbs.

TRUSS GABLE END. An engineered factory made truss or site built truss that incorporates factory installed or field installed vertical studs with their faces parallel to the plane of the truss and are spaced no greater than 24-inches on center. Web or other diagonal members other than top chords may or may not be present. Gable end trusses may be of the same height as nearby trusses or may be drop chord trusses in which the top chord of the truss is lower by the depth of the top chord or outlookers.

SECTION 1303
MATERIALS OF CONSTRUCTION

1303.1 Existing materials. All existing wood materials that will be part of the retrofitting work (trusses, rafters, ceiling joists, top plates, wall studs, etc.) shall be in sound condition and free from defects or damage that substantially reduce the load-carrying capacity of the member. Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions.

1303.2 New materials. All materials approved by this code, including their appropriate allowable stresses, shall be permitted to meet the requirements of this chapter.

1303.3 Dimensional lumber. All dimensional lumber for braces, studs, and blocking shall conform to applicable standards or grading rules. Dimensional lumber shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. All new dimensional lumber to be used for retrofitting purposes shall be a minimum grade and species of #2 Spruce-Pine-Fir or shall have a specific gravity of 0.42 or greater. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this code shall be accepted.

1303.4 Metal plate connectors, straps and anchors. Metal plate connectors, straps and anchors shall have product approval. They shall be approved for connecting wood-to-wood or wood-to-concrete as appropriate. Straps and tie plates shall be manufactured from galvanized steel with a minimum thickness provided by 20 gauge. Tie plates shall have holes sized for 8d nails.

1303.5 Twists in straps. Straps shall be permitted to be twisted 90 degrees in addition to a 90 degree bend where they transition between framing members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length.

1303.6 Fasteners. Fasteners meeting the requirements of Sections 1303.6.1 and 1303.6.2 shall be used and shall be permitted to be screws or nails meeting the minimum length requirement shown in figures and specified in tables.

1303.6.1 Screws. Screws shall be a minimum #8 size with head diameters no less than 0.3 inch. Screw lengths shall be no less than indicated in the Figures and in Tables. Permissible screws include deck screws, wood screws, or sheet metal screws (without drill bit type tip, but can be sharp pointed). Screws shall have at least 1 inch of thread. Fine threaded screws or drywall screws shall not be permitted. Note that many straps will not accommodate screws larger than #8.

1303.6.2 Nails. Unless otherwise indicated in the provisions or drawings, where fastener lengths are indicated in Figures and Tables as 1-¼ inch, 8d common nails with shank diameter 0.131 inch and head diameters no less than 0.3 inch shall be permitted. Unless otherwise indicated in the provisions or drawings, where fasteners lengths are indicated in Figures and Tables as 3 inch, 10d common nails with shank diameter of 0.148 inch and head diameters no less than 0.3 inch shall be permitted.

1303.7 Fastener spacing. Fastener spacing shall be as follows:

1. distance between fasteners and the edge of lumber shall be a minimum of ½ inch except where the holes in straps place fasteners closer to the edge. In that case, the minimum shall be1/4 inch unless otherwise indicated,
2. distance between fasteners and the end of lumber shall be a minimum of 2-½ inch,
3. distance between fasteners parallel to grain (center-to-center) when straps are not used shall be a minimum of 2-1/2 inches unless a ½-inch stagger (perpendicular to the grain) is applied for adjacent fasteners, then the distance between fasteners parallel to the grain shall be a minimum of 1-1/4 inches.
4. distance between fasteners across grain (row spacing) when straps are not used shall be a minimum of 1 inch, and the
5. distance between fasteners inserted in metal plate connectors, straps and anchors as defined in Section 1303.4 shall be those provided by holes manufactured into the straps.

SECTION 1304
RETROFITTING GABLE END WALLS

1304.1 Scope and intent. Gable ends to be strengthened shall be permitted to be retrofitted using methods prescribed by provisions of this section. The provisions of this section are limited to buildings with wood framed roof structures and mean roof height of 45 feet or less. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end wall construction for out-of-plane wind loads resulting from high wind events. The retrofit method addresses four issues. These include strengthening the framing members of the walls if necessary (retrofit studs), bracing the top and bottom of the gable wall so that lateral loads are transmitted into the roof and ceiling diaphragms (horizontal braces, straps to retrofit studs and compression blocks) and connecting the bottom of the gable end wall to the wall below to help brace the top of that wall (specialty metal brackets).

The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss or a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to or perpendicular to the gable wall surface. An overview perspective drawing of the retrofit is shown in Figure 1304.1.

1304.2 Horizontal braces. Horizontal braces shall be installed approximately perpendicular to the roof and ceiling framimg members at the location of each existing gable end wall stud greater than 3-feet in length.

The horizontal braces shall consist of the minimum size member indicated in Table 1304.2. The horizontal braces shall be oriented with their wide faces across the roof or ceiling framing members, be fastened to a minimum of three framing members, and extend at least 6-feet measured perpendicularly from the gable end wall plus 2-1/2 inch beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end wall as shown in Figure 1304.2.1 (and 1304.2.6). The horizontal brace shall be located no farther than $^1/_2$ inch from the inside face of the gable end wall truss. Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch long fasteners (#8 wood screws or 10d nails) as indicated in Figures 1304.2.2 through 1304.2.5 for trusses (and Figures 1304.2.7 through 1304.2.10 for conventionally framed).

If the spacing of existing gable end studs is greater than 24 inches or no vertical gable end stud is present, a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be 24–inches. Additional gable end wall studs shall not be required at locations where their length would be 3-feet or less. Each end of each required new stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using a minimum of two 3-inch toenail fasteners (#8 wood screws or 10d nails) and a metal connector or mending plate with a minimum of four 1-1/4 inch long fasteners (#8 wood screws or 8d nails).

Exceptions:

1. Where impediments, other permanently attached obstacles or conditions exist that will not permit installation of horizontal braces at the indicated locations, refer to Section 1304.5 for permitted modification of these prescriptive retrofit methods.
2. Where impediments, other permanently attached obstacles or conditions exist that will not permit extension of the horizontal braces across the existing framing members such that they can be fastened to a minimum of three framing members and extend at least 6-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member, the horizontal braces may be shortened provided that all of the following conditions are met.
   - 2.1. The horizontal brace shall be installed across a minimum of two framing spaces, fastened to each existing framing member with three 3-inch long fasteners (#8 wood screws or 10d nails), and extend a minimum of 4-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member.
   - 2.2. An anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure 1304.2.11. The minimum edge and face sizes of the anchor block shall be equivalent to the existing roof or ceiling framing members as appropriate for that particular installation. Six 3-inch long fasteners (#8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
   - 2.3. The anchor block shall extend into the space between the roof or ceiling framing members a minimum of one-half the depth of the existing framing members at the location where the anchor block is installed. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed $^1/_8$ inch.

1304.3 Retrofit studs. The retrofit studs shall consist of the minimum size members for the height ranges of the existing vertical gable end wall studs indicated in Table 1304.2. Retrofit studs shall be installed adjacent to the existing or added (Section 1304.2) vertical gable end wall studs and extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace. A maximum gap of 1/8-inch shall be permitted between the retrofit stud and the bottom horizontal brace. A maximum gap of 1/2-inch shall be permitted between the top edge of the retrofit stud closest to the upper horizontal brace and the horizontal brace surface.

Exception: Where impediments, other permanently attached obstacles or conditions exist that will not permit the installation of a new retrofit stud adjacent to an existing gable end wall stud, refer to Section 1304.5 for permitted modification of these prescriptive retrofit methods.

1304.3.1 Retrofit stud fastening. Each retrofit stud shall be fastened to the top and bottom horizontal brace members with a minimum of a 20 gauge, 1-1/4 inch wide flat or coil metal strap with pre-punched fastener holes. The flat metal straps shall be the minimum length as indicated in Table 1304.2. Each top and bottom strap shall extend sufficient distance onto the vertical face of the retrofit stud and be fastened with the number of 1-1/4 inch long fasteners (#8 wood screws or 8d nails) indicated in Table 1304.2. Each strap shall be fastened to the top and bottom horizontal brace members with the minimum number of 1-1/4 inch long fasteners (#8 wood screws or 8d nails) as indicated in Table 1304.2. The retrofit stud members shall also be fastened to the side of the existing vertical gable end wall studs with 3-inch long fasteners (#8 wood screws or 10d nails) spaced at 6-inches on center as shown in Figure 1304.2.1.

1304.3.2 Retrofit stud splices. Retrofit studs greater than 8-feet in height may be field spliced as shown in Figure 1304.3.

1304.4 Compression blocks. Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. For clarity, Figures 1304.2.2 through 1304.2.5 (trusses) and Figures 1304.2.7 through 1304.2.10 (conventionally framed) show the installation of the compression block against the existing vertical gable end wall stud with the strap from the retrofit stud running beside the compression block. When the compression block is installed against the retrofit stud, the block shall be allowed to be placed on top of the strap. A maximum gap between the compression block and the existing vertical gable end wall stud member or retrofit stud of $^{1}/_{8}$ inch shall be permitted. Compression blocks shall be fastened to the horizontal braces with the minimum number of 3-inch long fasteners (#8 wood screws or 10d nails) specified in Table 1304.2. End and edge distances for fastener installation shall be as listed in Section 1303.7 and shown in Figures 1304.2.2 through 1304.2.5 (trusses) and Figures 1304.2.7 through 1304.2.10 (conventionally framed).

1304.5 Impediments– permissible modifications to prescriptive gable end retrofits. Where impediments, other permanently attached obstacles or conditions exist in attics that preclude the installation of a retrofit stud or horizontal braces in accordance with Sections 1304.2 or 1304.3, the gable end retrofit shall be deemed to meet the requirements of this section if the requirements of Section 1304.5.1 are met. Impediments to the installation of retrofit studs or horizontal braces include gable end vents, attic accesses, recessed lights, skylight shafts, chimneys, air conditioning ducts, or equipment. Where the installation of a horizontal brace for the top of a center stud is obstructed by truss plates near the roof peak, methods prescribed in 1304.5.1 are permitted to be used, or retrofit ridge ties as prescribed in Section 1304.5.2 are permitted to be used to support the horizontal brace.

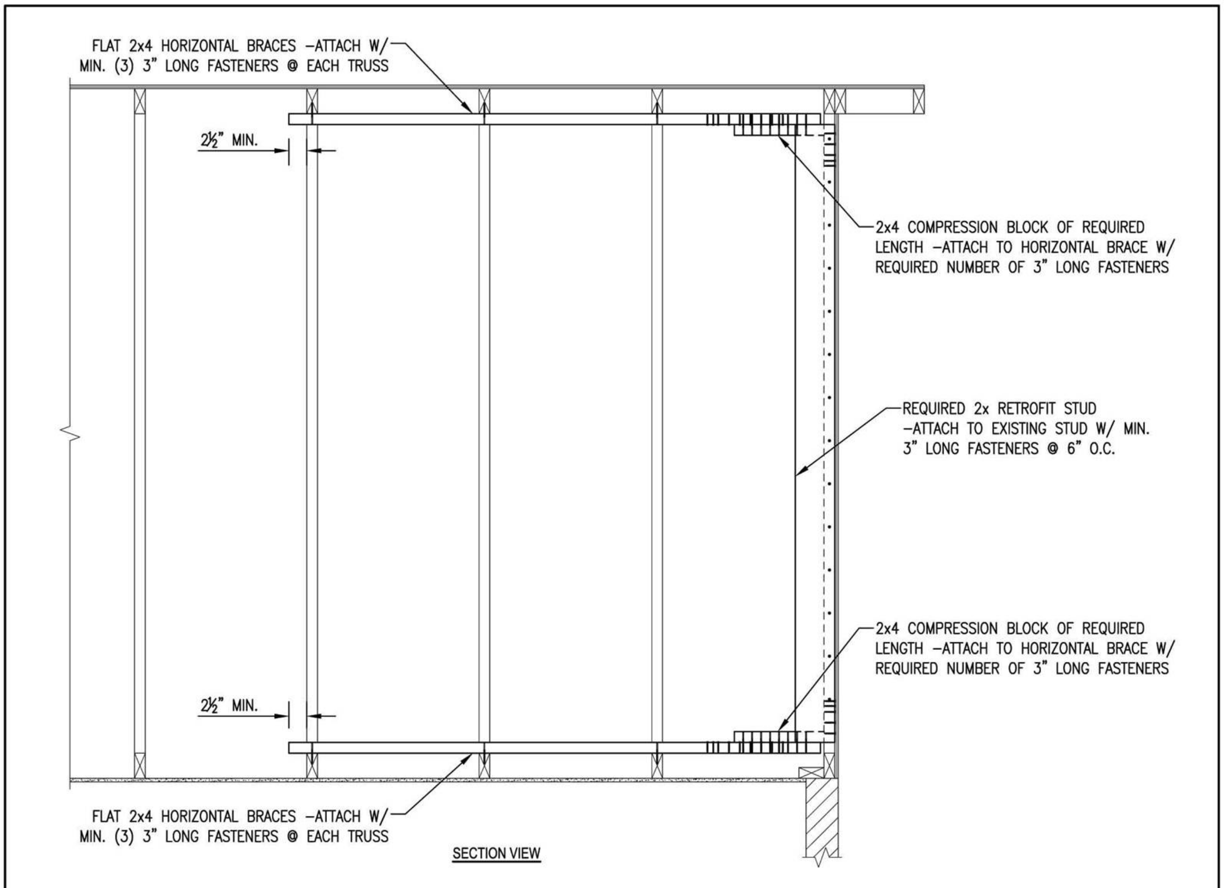

FIGURE 1304.2.1 SECTION VIEW OF GABLE END RETROFIT (TRUSS WALL)

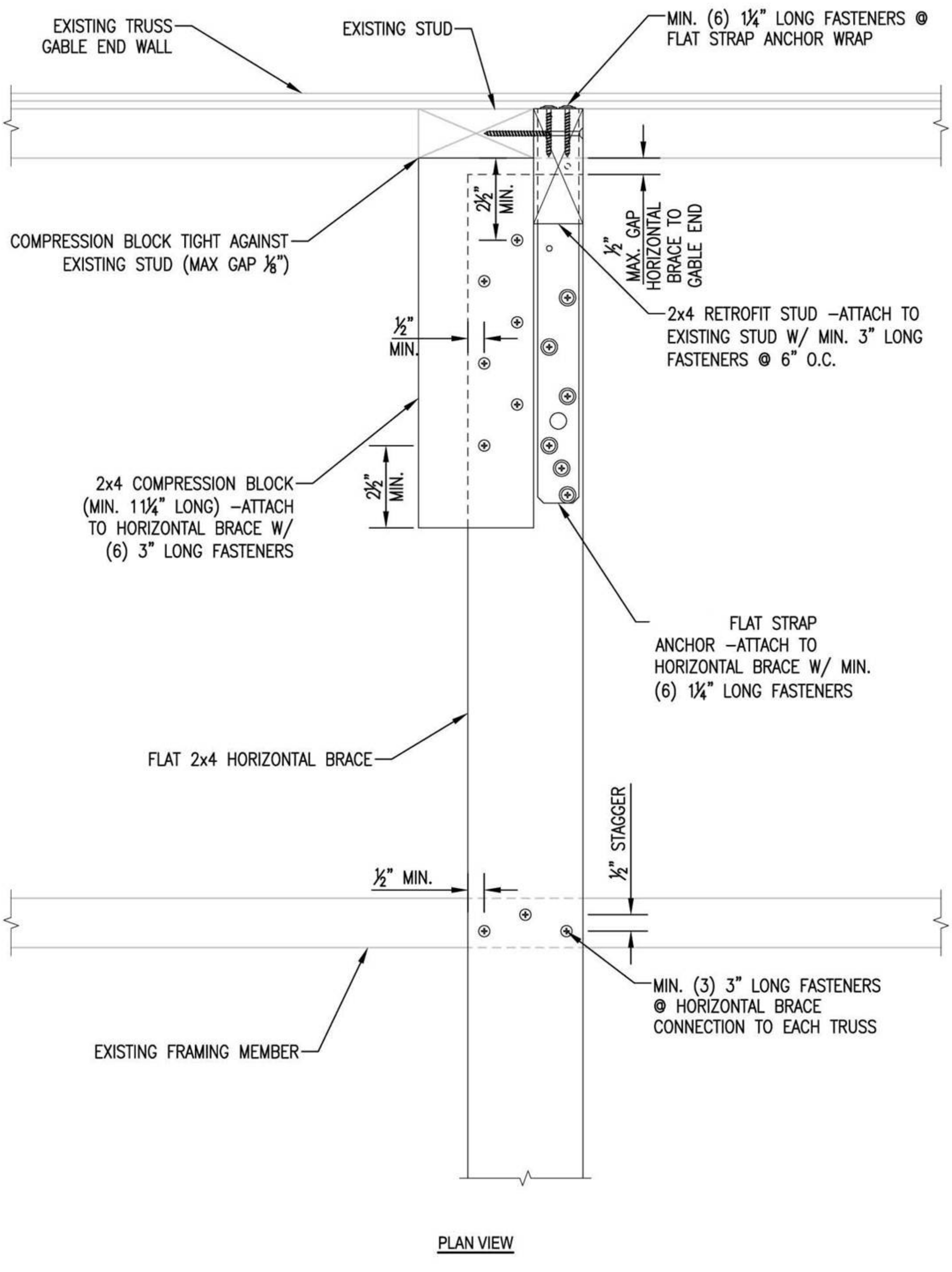

FIGURE 1304.2.2 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x4 RETROFIT STUD

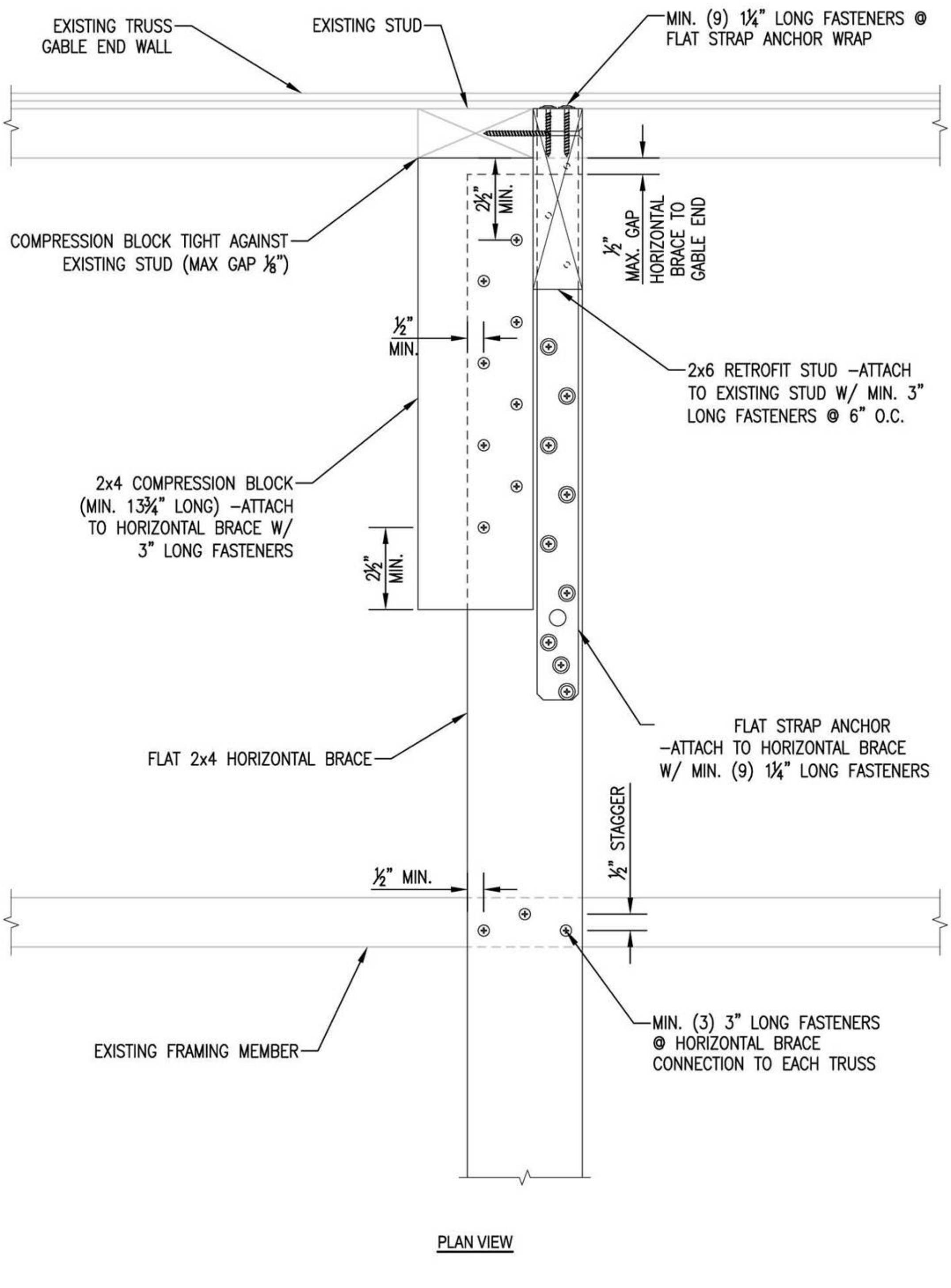

FIGURE 1304.2.3 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x6 RETROFIT STUD

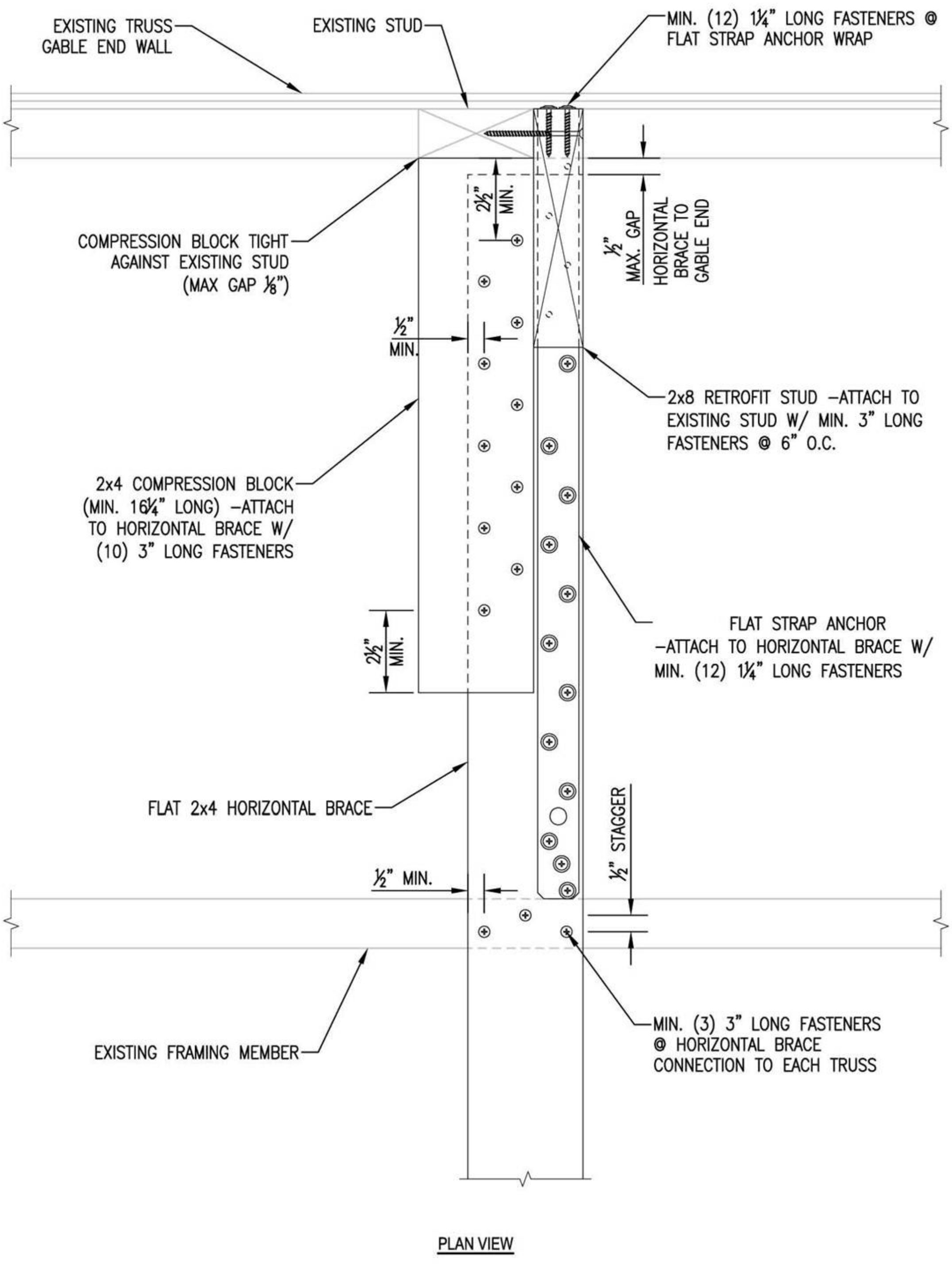

FIGURE 1304.2.4 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x8 RETROFIT STUD

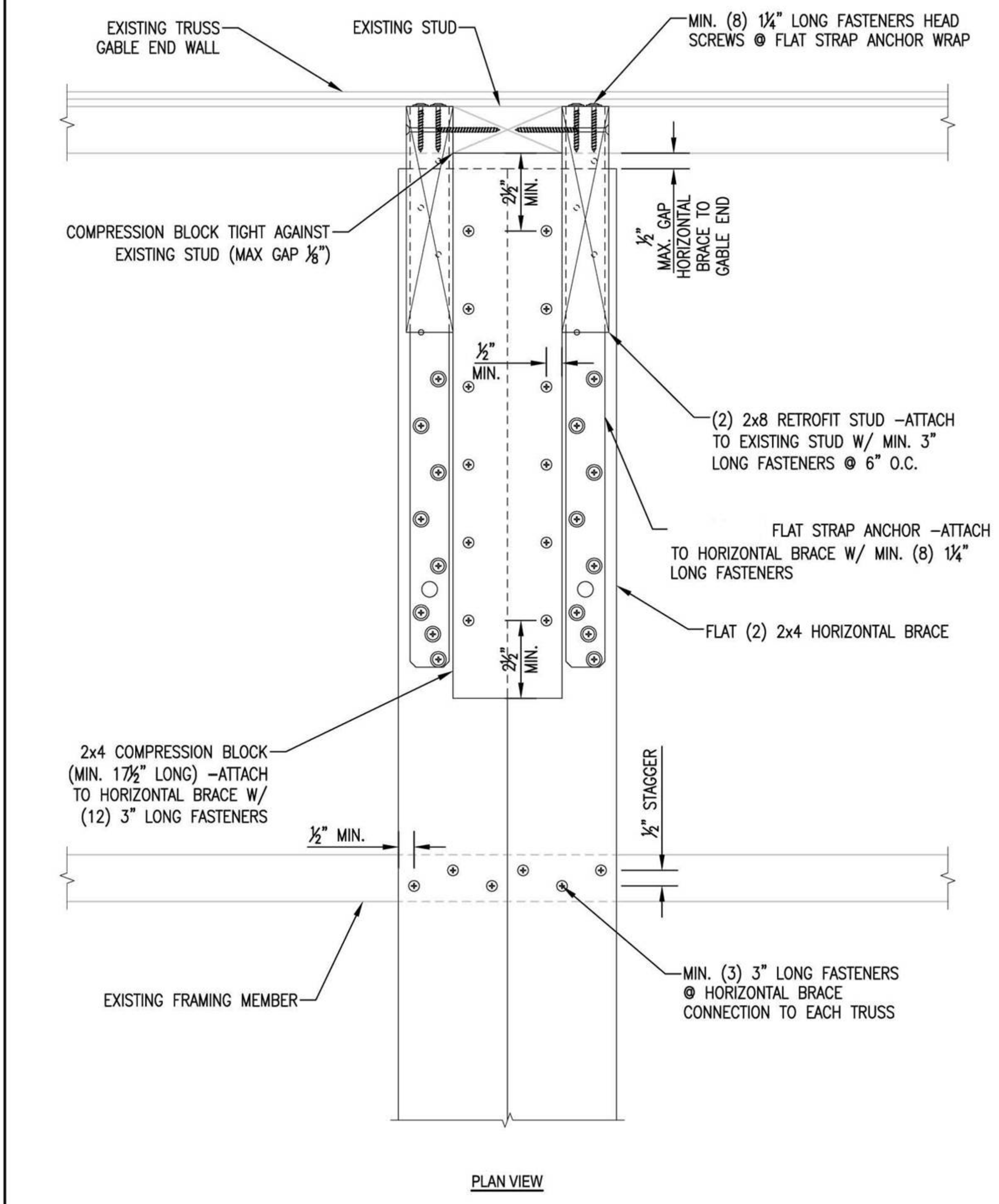

FIGURE 1304.2.5 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – (2)2x8 RETROFIT STUD

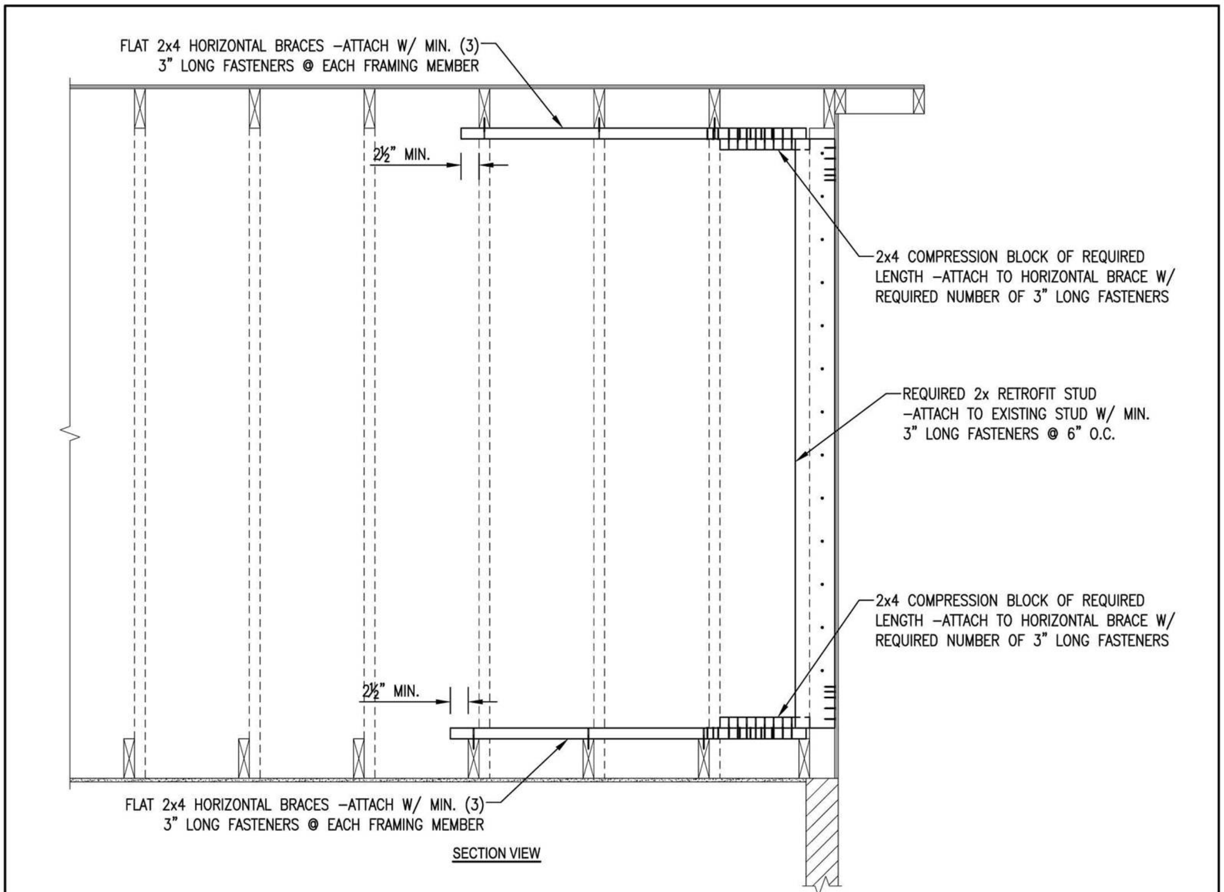

FIGURE 1304.2.6 SECTION VIEW OF GABLE END RETROFIT (CONVENTIONAL FRAMED)

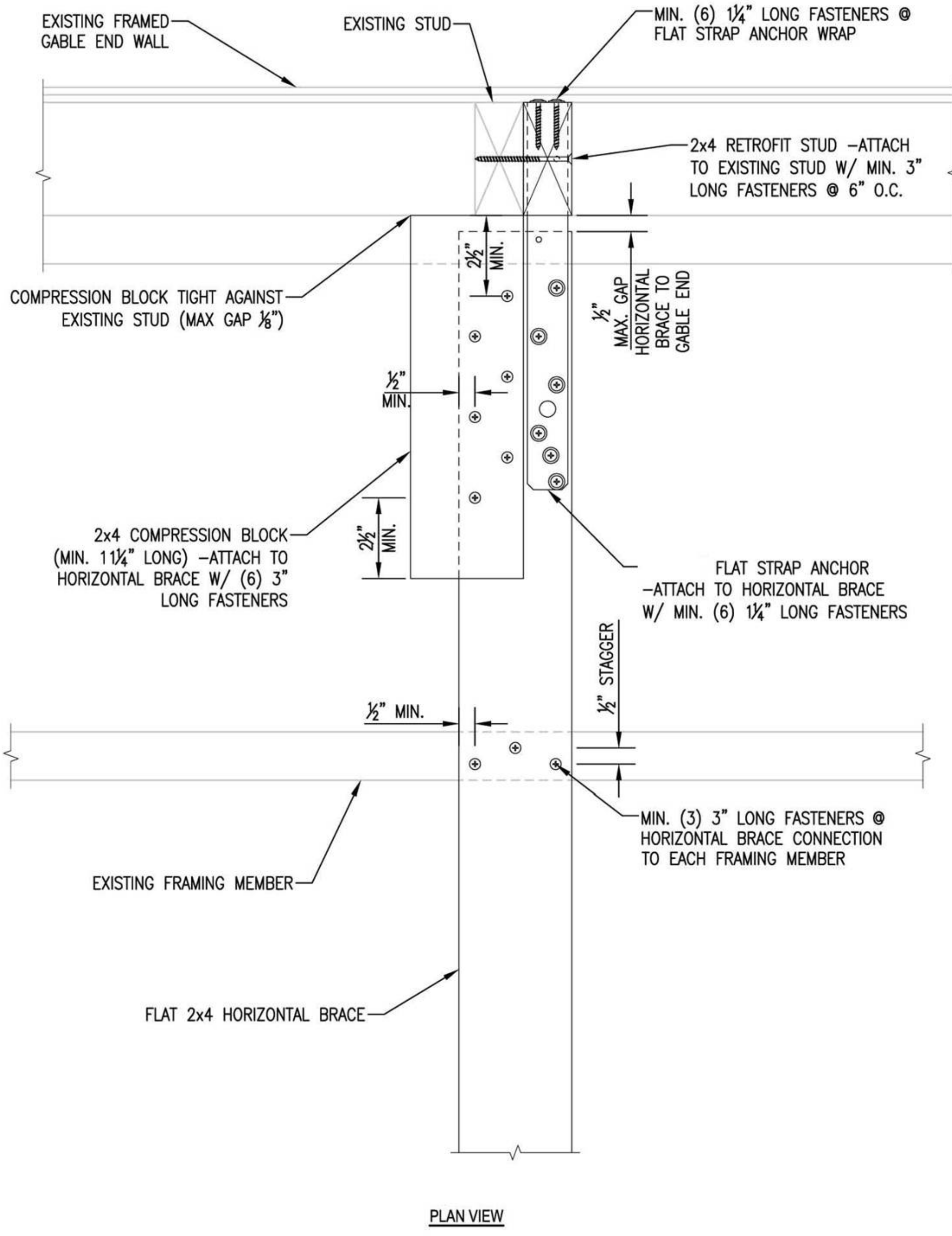

FIGURE 1304.2.7 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x4 RETROFIT STUD

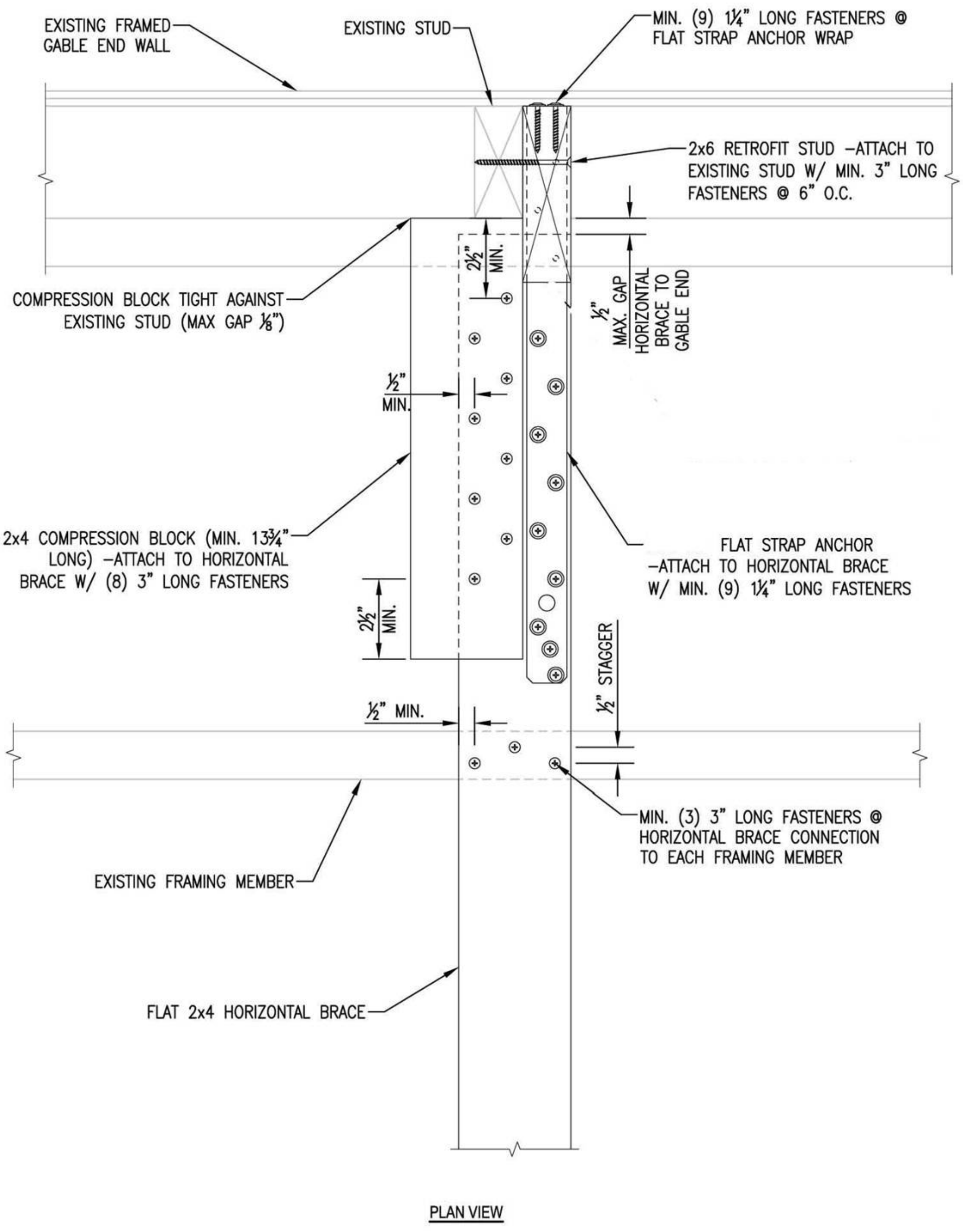

FIGURE 1304.2.8 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x6 RETROFIT STUD

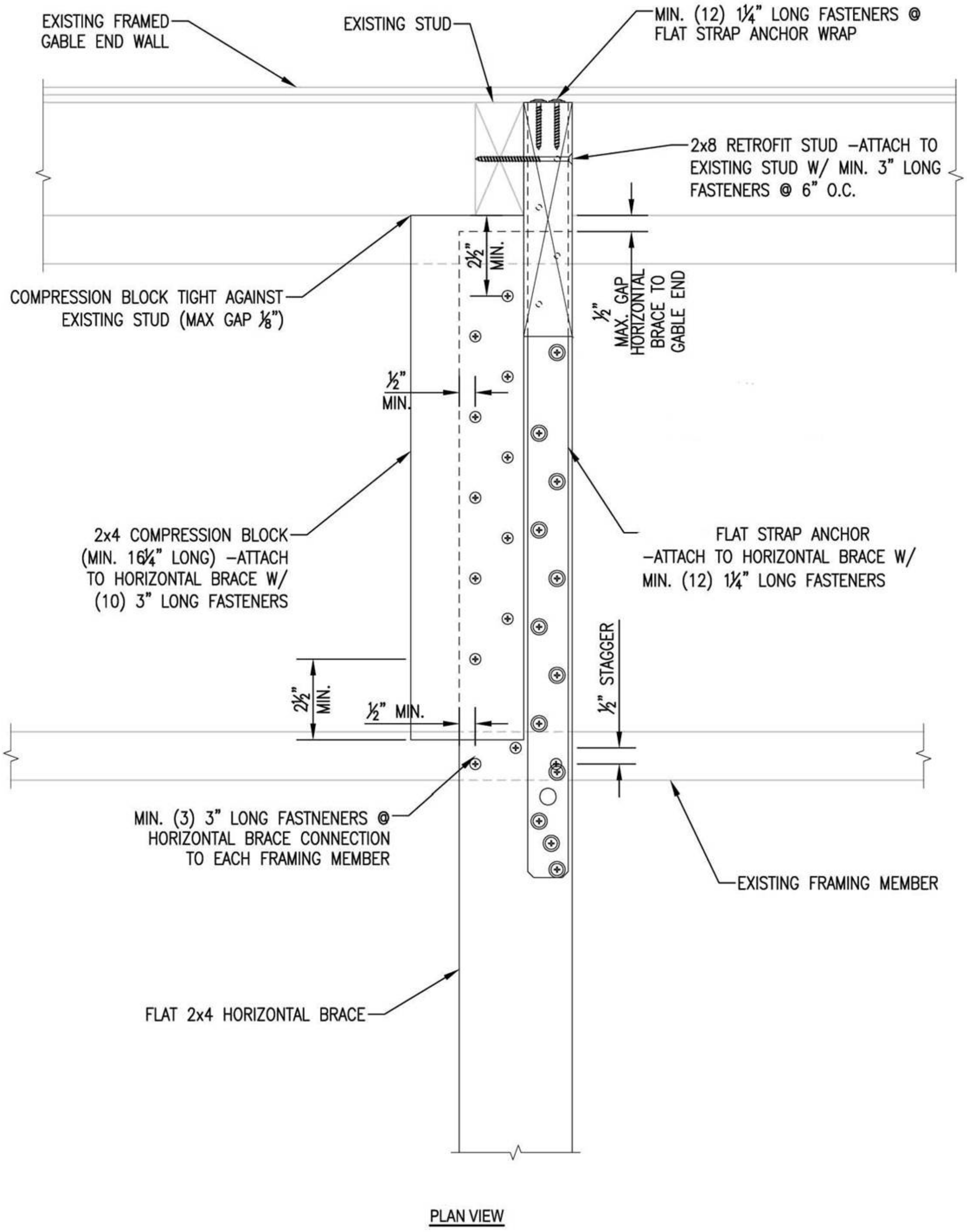

FIGURE 1304.2.9 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x8 RETROFIT STUD

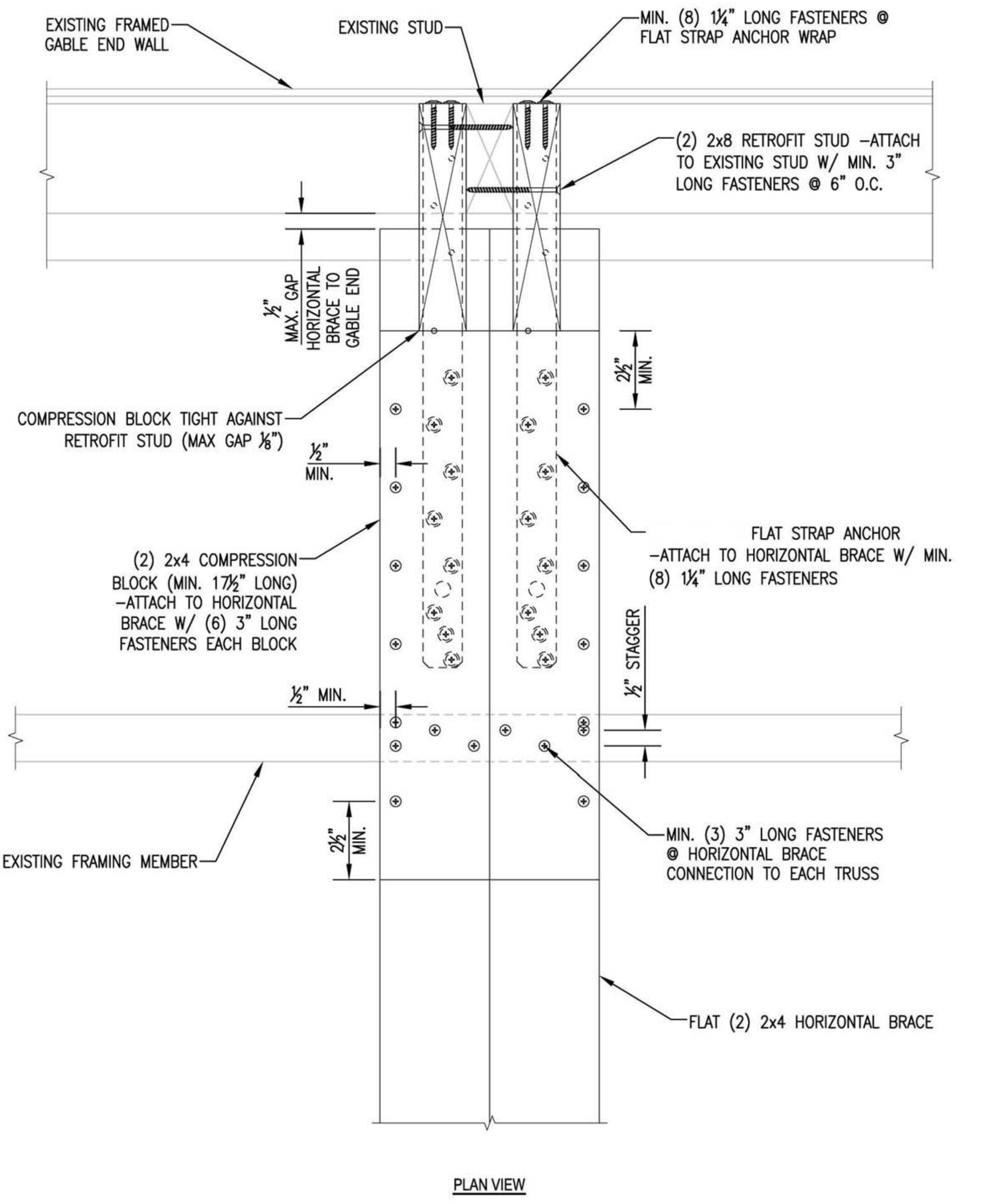

FIGURE 1304.2.10 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – (2)2x8 RETROFIT STUD

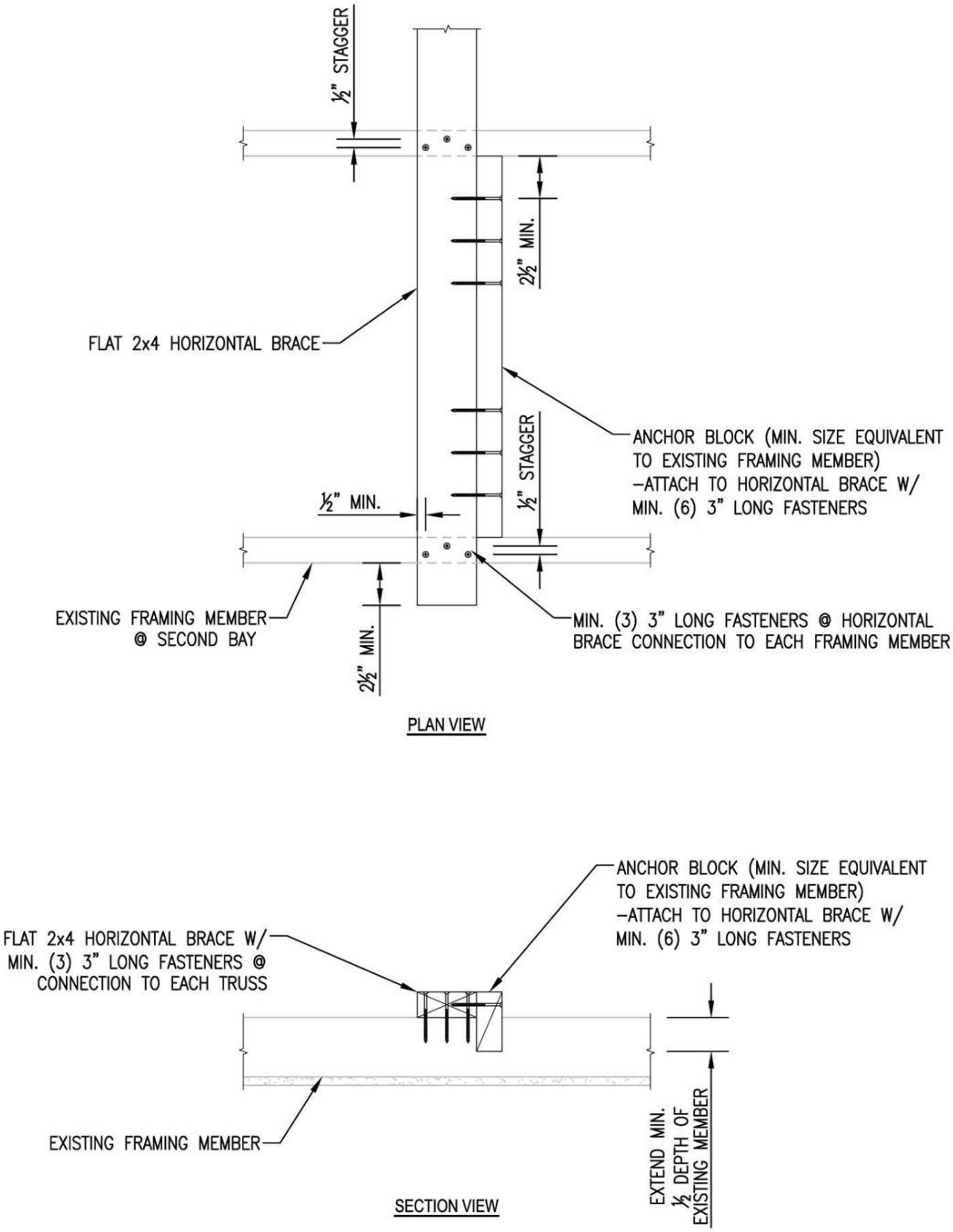

FIGURE 1304.2.11 DETAIL OF ANCHOR BLOCK INSTALLATION

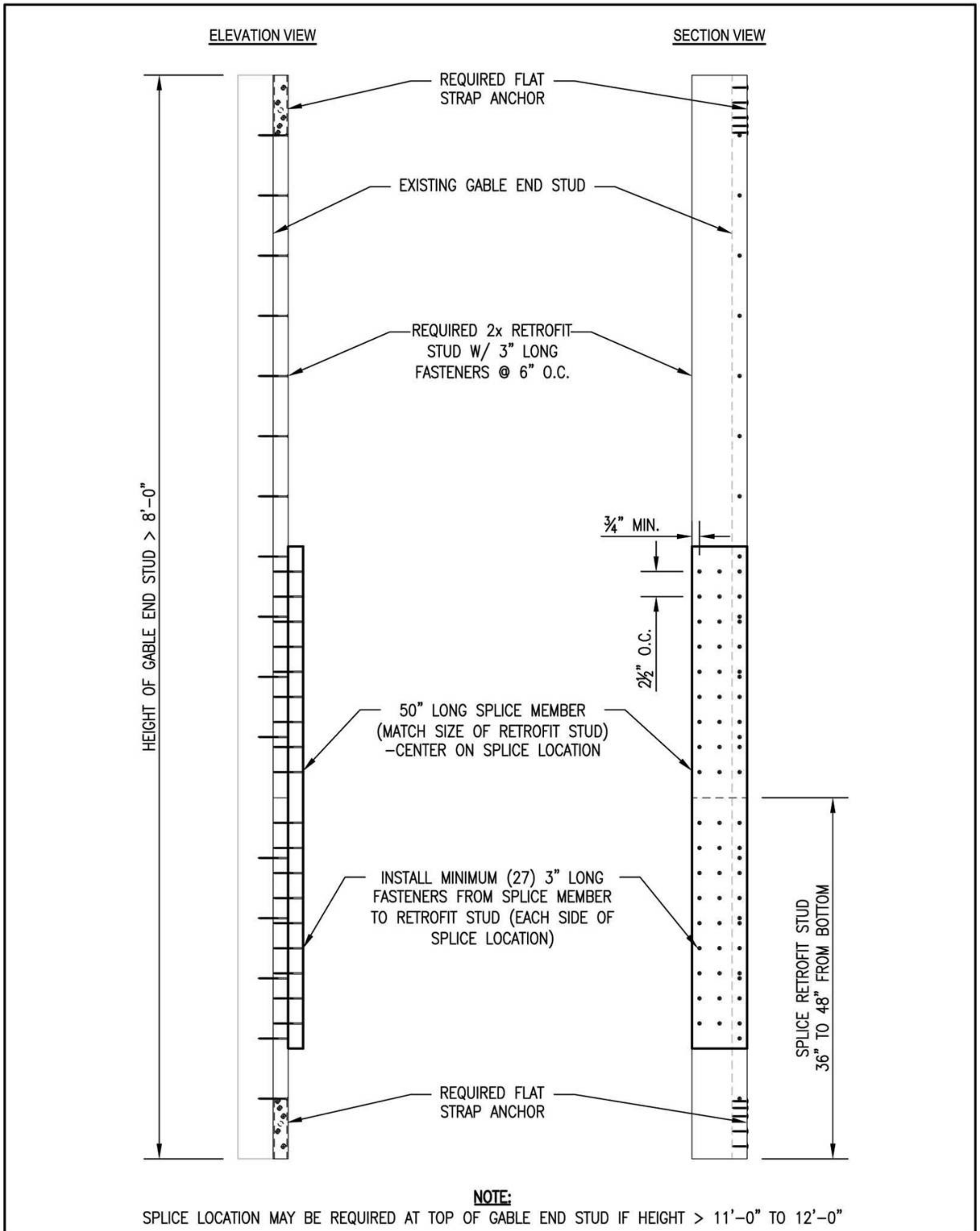

FIGURE 1304.3 DETAIL OF RETROFIT STUD SPLICE

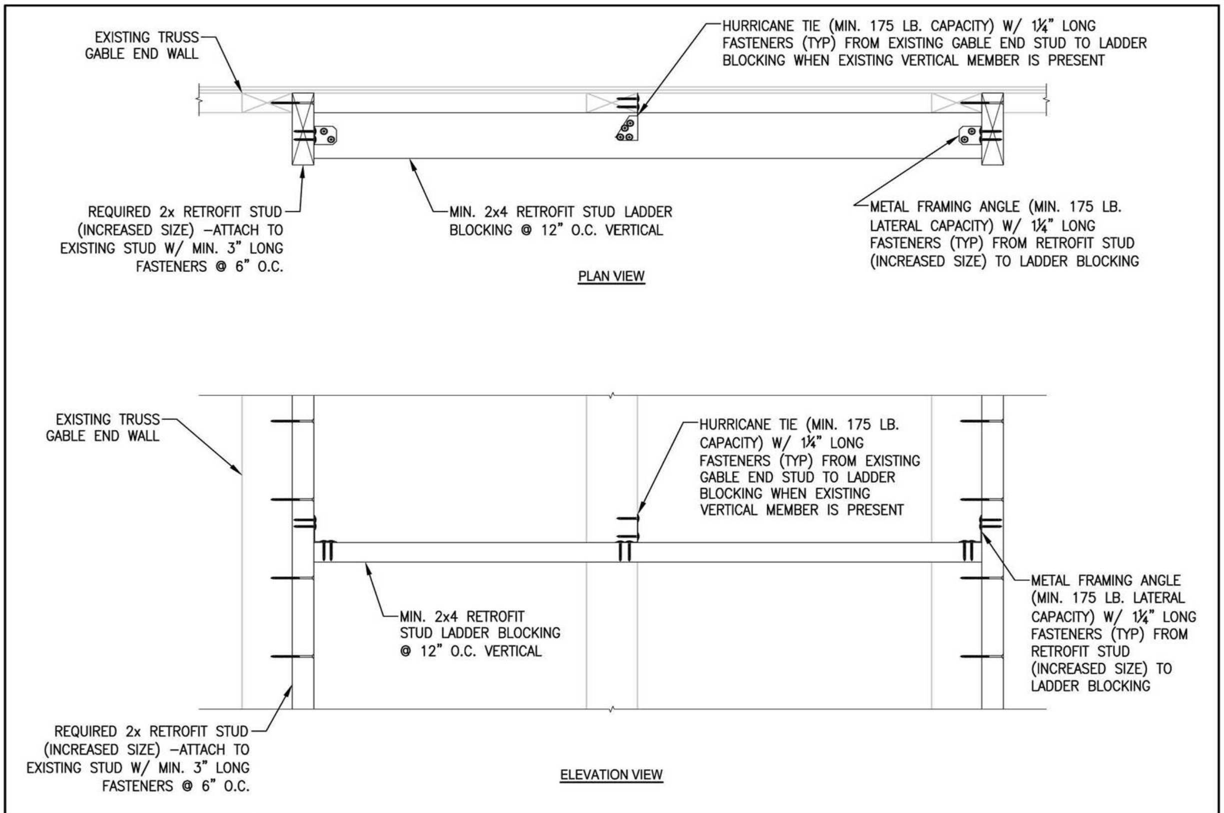

FIGURE 1304.5.1.1 DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (TRUSS GABLE END)

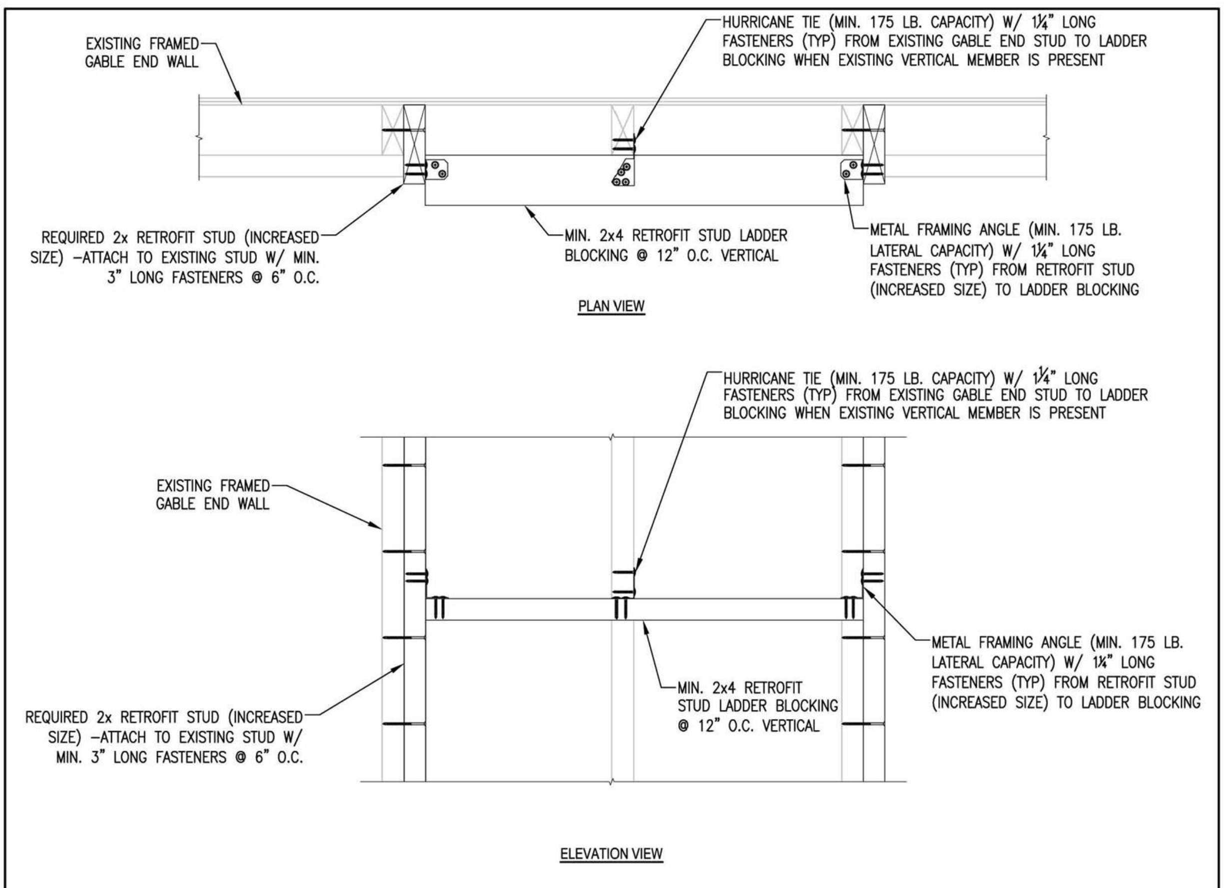

FIGURE 1304.5.1.2 DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (CONVENTIONAL FRAMING)

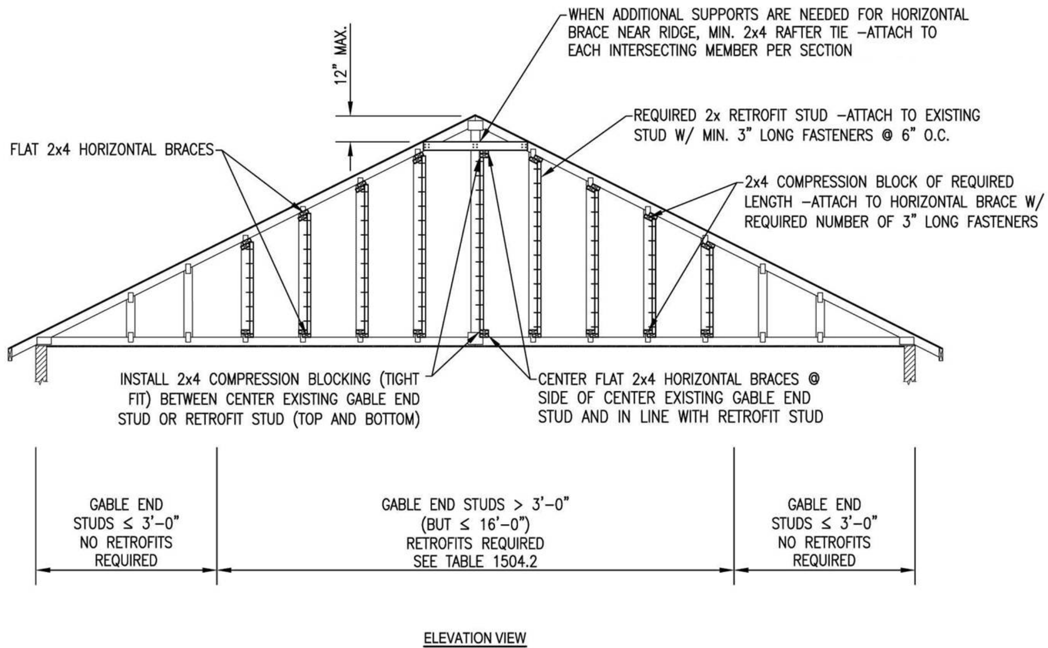

FIGURE 1304.5.2 DETAIL OF RETROFIT RIDGE TIE INSTALLATION

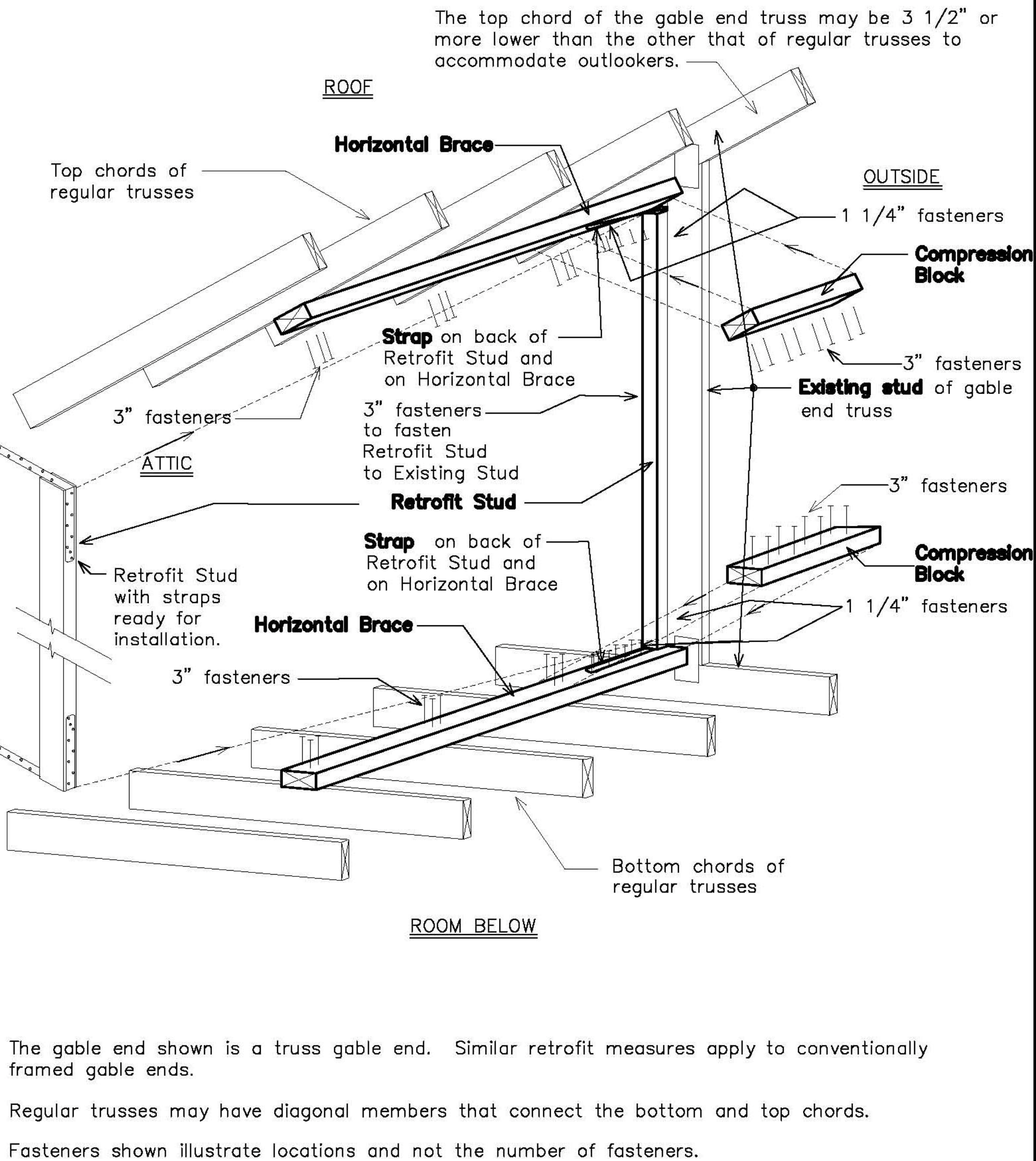

FIGURE 1304.1
RETROFIT DETAILS FOR TRUSS GABLE ENDS

<u>**1304.5.1 Remedial measures where obstacles prevent installation of retrofit studs or horizontal braces.** If a retrofit stud or horizontal brace cannot be installed because of an impediment, the entire assembly can be omitted from that location provided all of the following conditions are met.</u>

1. <u>No more than two assemblies of retrofit studs and horizontal braces are omitted on a single gable end.</u>
2. <u>There shall be at least two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (no two ladder braces bearing on a single retrofit stud).</u>

3. The retrofit studs on each side of the omitted retrofit stud are increased to the next indicated member size in Table 1304.2 and fastened as indicated in Section 1304.3.1.
4. The horizontal bracing members on each side of the omitted brace shall be sized in accordance with Table 1304.2 for the required retrofit studs at these locations.
5. The horizontal bracing members on each side of the omitted brace shall meet the requirements of Section 1304.2.
6. Ladder bracing is provided across the location of the omitted retrofit studs as indicated in Figures 1304.5.1.1 (trusses) and 1304.5.1.2 (conventionally framed).
7. Ladder bracing shall consist of a minimum 2x4 members oriented horizontally and spaced a maximum of 12-inches on center vertically. Ladder bracing shall be attached to each adjacent retrofit stud with a metal framing angle with a minimum lateral capacity of 175 lbs. Ladder bracing shall be attached to the existing stud at the location of the omitted retrofit stud with a metal hurricane tie with a minimum capacity of 175 lbs.
8. Where ladder bracing spans across a gable end vent, the gable end vent framing shall be attached to the ladder bracing using metal straps or clips.
9. Notching of the ladder bracing shall not be permitted unless the net depth of the framing member is a minimum of 3-1/2 inches.

1304.5.2 Retrofit ridge ties. When impediments along the ridge of the roof impede the installation of a horizontal brace for one or more studs near the middle of the gable wall, retrofit ridge ties may be used to provide support for the required horizontal brace. The top of retrofit ridge tie members shall be installed a maximum of 12-inches below the existing ridge line or 4-inches below the impediment(s). The retrofit ridge tie members shall be installed across a minimum of three bays, but no less than 6-feet to permit fastening of the horizontal brace. A minimum of a 2x4 member shall be used for each ridge tie and fastening shall consist of two 3-inch long wood screws, four 3-inch long 10d nails or two 3-1/2 inch long 16d nails driven through and clinched at each top chord or web member intersected by the ridge tie as illustrated in Figure 1304.5.2.

1304.5.3 Notching of retrofit studs. Retrofit studs may be notched in one location along the height of the stud member provided that all of the following conditions are met.

1. The retrofit stud to be notched shall be sized such that the remaining depth of the member at the location of the notch (including cut lines) shall not be less than that required by Table 1304.2.
2. The notched retrofit stud shall not be spliced within 12 inches of the location of the notch. The splicing member shall not be notched and shall be installed as indicated in Figure 1304.3.
3. The length of the flat metal straps indicated in Table 1304.2 shall be increased by the increased depth of the notched retrofit stud member to be installed.
4. The height of the notch shall not exceed 12 inches vertically as measured at the depth of the notch.
5. The notched retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section 1304.3.1. Two additional 3-inch fasteners (#8 wood screws or 10d nails) shall be installed on each side of the notch in addition to those required by Section 1304.3.1.

1304.6 Connection of gable end wall to wall below. The bottom chords or bottom members of wood framed gable end walls shall be attached to the wall below using one of the methods prescribed in Sections 1304.6.1 or 1304.6.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered.

1304.6.1 Truss gable end wall. The bottom chords of the gable end wall shall be attached to the wall below using right angle brackets consisting of 14 gage or thicker material with a minimum specified load capacity of 350 lbs perpendicular to the plane of either face of the connector. The right angle brackets shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet at the spacing specified in Table 1304.6. A minimum of two of the fasteners specified by the manufacturer shall engage the body of the bottom chord. Connection to the wall below shall be by one of the methods listed below:

1. For a wood frame wall below, two fasteners of the same diameter and style specified by the bracket manufacturer shall engage the body of the bottom top plate of the wall below.
2. For a concrete or masonry wall below without a sill plate, the fasteners into the wall shall be consistent with the bracket manufacturer's specifications for fasteners installed in concrete or masonry.
3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the bracket manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the bracket can be anchored to the sill plate using fasteners consistent with the bracket manufacturer's specifications for wood connections, provided that the sill plate is anchored to the wall on each side of the bracket by a 1/4-inch diameter masonry screw with a 2-1/2 inch embedment into the concrete or masonry wall. ¼-inch washers shall be placed under the heads of the masonry screws.

1304.6.2 Conventionally framed gable end wall. Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3-feet, shall be attached to the bottom or sill plate using a stud to plate connector. The bottom or sill plate shall then be connected to the wall below using one of the methods listed below:

1. For a wood frame wall below, two fasteners of the same diameter and style specified by the bracket manufacturer shall engage the body of the bottom top plate of the wall below. The fasteners shall be installed at the spacing indicated in Table 1304.6.
2. For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼-inch diameter concrete or masonry screws of sufficient length to provide a 2-1/2 inch embedment into the top of the concrete or masonry wall. The fasteners shall be installed at the spacing indicated in Table 1304.6.

(Renumber subsequent chapters)

Reason: The purpose of the proposed addition is to provide prescriptive means for retrofitting gable ends to resist high winds. This code addition will facilitate the retrofitting of gable ends without requiring site specific engineering for common applications, thus removing some of the obstacles that might impede this important retrofit in hurricane prone regions.

Reason for adding provisions for retrofitting gable ends

Gable end failures are one of the most common types of structural failures observed in hurricanes. They have been documented in most major hurricanes and in many weaker hurricanes. Analysis of damage in Hurricane Charley which struck Port Charlotte in 2004 demonstrated that homes built to meet the high wind requirements such as those specified in the ICC Building and Residential codes suffered very little structural damage while older homes built to weaker codes or using conventional construction suffered significant damage.

The proposed code addition is intended to be a prescriptive approach to reduce retrofitting costs, facilitate retrofitting, minimize the need for engineering, and facilitate code review and inspection. The addition will provide standardized off the shelf methods that can be readily approved and easily inspected by building department personnel. Building departments can thus become creditable third party resources for authenticating retrofitting just as they do for other structural issues of buildings.

It should be recognized that almost no attempt to retrofit will actually weaken or compromise a building or subject surrounding buildings to risk, on the contrary all will benefit. The retrofitting is voluntary.

Reason for adding retrofit measures to the code

Because most America's buildings located in hurricane prone regions were not built to today's building codes standards, there is significant value added to the code if the retrofitting of buildings could be facilitated by the provision of prescriptive means. This would inherently reduce the cost of retrofitting. The need for structural retrofitting has been highlighted in the recent spate of hurricanes and the insurance crises that has developed in the coastal high wind areas of a number of states because of older buildings that do not meet current building code structural requirements. Clearly, it is in the public's health, welfare, and safety to facilitate retrofitting. Given the importance of retrofitting to the public, retrofitting of buildings should be encouraged and facilitated by removing as many impediments as possible. The code can actually facilitate and encourage retrofitting by providing prescriptive means. Such methods should encourage, facilitate, and reduce the cost of improving America's building stock.

Reason for location in code

Clearly, prescriptive retrofit methods should be located in the *International Existing Building Code.* At first blush a reasonable point to insert such methods would be in chapter 4, Repairs; however, existing conditions are not necessarily broken, thus not needing repair. The distinction between repair and retrofit needs to be maintained to avoid confusion with those that require conformance to building codes (repairs) and retrofit measures are that are voluntary and not mandatory.

Consequently, the preferred approach is to add a chapter that deals specifically with retrofitting of a voluntary nature. The advantage of this approach is that it easily allows for additional retrofit measures to be added without confusing code users by gable end retrofit being in the repair section and then changing its location to a separate chapter in a subsequent edition when more retrofit measures are added. Further by grouping retrofit measures into a separate chapter users will find them and perhaps even use the chapter as a catalog of potential retrofit measures. Additionally, grouping voluntary measures into a separate chapter, a chapter separate from mandatory measures, will make code administration less prone to confusion. Logically the new chapter would be inserted after chapter 12 so that it would fall in the sequence of classifications of work defined in chapter 4 thus making it chapter 13.

A separate chapter for a single method? Yes, because it is anticipated to be but the first retrofit issue to be inserted into the code. And yes because of the somewhat peculiar nature of the voluntary nature of retrofitting. Although retrofit language reads with shall language the whole notion of retrofitting is not `shall', but voluntary.

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

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

EB45–07/08
A202

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

SECTION A202
SCOPE

The provisions of this chapter shall apply to wall anchorage systems that resist out-of-plane forces and to collectors in existing reinforced concrete or reinforced masonry buildings with flexible diaphragms. Wall anchorage systems that were designed and constructed in accordance with the 1997 *Uniform Building Code*, 1999 *BOCA National Building Code*, 1999 *Standard Building Code* or the 2000 and subsequent editions of the *International Building Code* shall be deemed to comply with these provisions.

Reason: Editorial. To clarify the scope of this chapter. Collectors are referenced in this chapter but not in the scope statement of current section A202.

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

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

EB46–07/08
A206

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

1. Delete without substitution:

~~**A206.3.1 Collectors.** If collectors are not present at reentrant corners, they shall be provided. New collectors shall be designed for the capacity required to develop into the diaphragm a force equal to the lesser of the rocking or shear capacity of the reentrant wall or the tributary shear. The capacity of the collector need not exceed the capacity of the diaphragm to deliver loads to the collector. A connection shall be provided from the collector to the reentrant wall to transfer the full collector force (load). If a truss or beam other than a rafter or purlin is supported by the reentrant wall or by a column integral with the reentrant wall, then an independent secondary column is required to support the roof or floor members whenever rocking or shear capacity of the reentrant wall is less than the tributary shear.~~

2. Revise as follows:

~~**A206.9**~~ **A206.8 Anchorage at interior walls.** Existing interior reinforced concrete~~,~~ or reinforced masonry walls that extend to the floor above or to the roof diaphragm~~,~~ shall be anchored for out-of-plane forces per Sections A206.1 and A206.3.Walls extending through the roof diaphragm shall be anchored for out-of-plane forces on both sides, and continuity ties shall be spliced across or continuous through the interior wall, to provide diaphragm continuity. ~~In the in-plane direction, the walls may be isolated or shall be developed into the diaphragm for a lateral force equal to the lesser of the rocking or shear capacity of the wall or the tributary shear, but need not exceed the diaphragm capacity.~~

3. Add new text as follows:

A206.9 Collectors. If collectors are not present at reentrant corners or interior shear walls, they shall be provided. Existing or new collectors shall be designed for the capacity required to develop into the diaphragm a force equal to the lesser of the rocking or shear capacity of the reentrant wall or the tributary shear based on 75 percent of the horizontal forces specified in Chapter 16 of the *International Building Code*. The capacity of the collector need not exceed the capacity of the diaphragm to deliver loads to the collector. A connection shall be provided from the collector to the reentrant wall to transfer the full collector force (load). If a truss or beam other than a rafter or purlin is supported by the reentrant wall or by a column integral with the reentrant wall, then an independent secondary column is required to support the roof or floor members whenever rocking or shear capacity of the reentrant wall is less than the tributary shear.

4. **Revise as follows:**

~~A206.8~~ A206.10 Mezzanines. Existing mezzanines relying on reinforced concrete or reinforced masonry walls for vertical and/or lateral support shall be anchored to the walls for the tributary mezzanine load. Walls depending on the mezzanine for lateral support shall be anchored per Sections A206.1, A206.2 and A206.3.

> **Exception:** Existing mezzanines that have independent lateral and vertical support need not be anchored to the walls.

Reason: To improve organization, flow, and clarity of section A206.

The proposal is primarily a reorganization, with three clarifications that do not change the scope of intended or required work. The proposal does the following:

- Combines the collector requirements, currently in two different sections (A206.3.1 and A206.9) into a single section as A206.9.
- Separates current section A206.9 into proposed section A206.8 for out-of-plane anchorage and proposed section A206.9 for in-plane collectors.
- Clarifies, in proposed section A206.8, that at interior walls, it is not adequate to simply provide out-of-plane wall anchors; diaphragm ties must be continuous through or across interior walls.
- Clarifies, in proposed section A206.9, that collectors are required for interior shear walls as well as reentrant corners.
- Clarifies, in proposed section A206.9, the force level for collector design/check.
- Moves the mezzanine provisions to the end of the section, for better and more logical flow.

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

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

EB47–07/08
A206.2

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the building code without the use of the 1.33 short duration allowable stress increase when using allowable stress design. ~~A load increase of 1.4 shall be used when designing with the *Uniform Building Code* for allowable stress design. No load increase is required when using the *International Building Code*.~~

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

> **Exception:** Existing cast-in-place shear anchors may be used as wall anchors if the tie element can be readily attached to the anchors and if the engineer or architect can establish tension values for the existing anchors through the use of approved as-built plans or testing and through analysis showing that the bolts are capable of resisting the total shear load (including dead load) while being acted upon by the maximum tension force due to an earthquake. Criteria for analysis and testing shall be determined by the building official.

Expansion anchors are only allowed with special inspection and approved testing for seismic loading.

Attaching the edge of plywood sheathing to steel ledgers is not considered compliant with the positive anchoring requirements of this chapter. Attaching the edge of steel decks to steel ledgers is not considered as providing the positive anchorage of this chapter unless testing and/or analysis are performed to establish shear values for the attachment perpendicular to the edge of the deck. Where steel decking is used as a wall anchor system, the existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

Reason: To remove reference to the UBC and be consistent with the IBC.

The 1.4 factor for steel design is included in Section 12.11.2.1 of ASCE 7-05 and is no longer required here.

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

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

EB48–07/08
A205.1, A206.1, A206.3

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

A205.1 General. The seismic-resisting elements specified in this chapter shall comply with provisions of Chapter 16 of the ~~building code~~ *International Building Code*, except as modified herein.

A206.1 Reinforced concrete and reinforced masonry wall anchorage. Concrete and masonry walls shall be anchored to all floors and roofs that provide lateral support for the wall. The anchorage shall provide a positive direct connection between the wall and floor or roof construction capable of resisting 75 percent of the horizontal forces specified in ~~the building code~~ Chapter 16 of the *International Building Code*.

A206.3 Development of anchor loads into the diaphragm. Development of anchor loads into roof and floor diaphragms shall comply with ~~the building code~~ Chapter 16 of the *International Building Code* using horizontal forces that are 75 percent of those used for new construction.

> **Exception:** If continuously tied girders are present, the maximum spacing of the continuity ties is the greater of the girder spacing or 24 feet (7315 mm).

In wood diaphragms, anchorage shall not be accomplished by use of toenails or nails subject to withdrawal. Wood ledgers, top plates or framing shall not be used in cross-grain bending or cross-grain tension. The continuous ties required in Chapter 16 of the ~~building code~~ *International Building Code* shall be in addition to the diaphragm sheathing.

Lengths of development of anchor loads in wood diaphragms shall be based on existing field nailing of the sheathing unless existing edge nailing is positively identified on the original construction plans or at the site.

Reason: Editorial. To update and specify references to the code for new construction.

Current references to "the building code" are improved by reference to a specific chapter or section. Once a specific section is referenced, a specific code should be referenced as well.

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

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

EB49–07/08
Table A5A-C

Proponent: Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

Delete tables without substitution:

~~**TABLE A5-A—BASIC STRUCTURAL CHECKLIST**~~

~~**TABLE A5-B—SUPPLEMENTAL STRUCTURAL CHECKLIST**~~

~~**TABLE A5-C—GEOLOGIC SITE HAZARD AND FOUNDATION CHECKLIST**~~

Reason: Editorial clarification.

These tables should have been deleted in conjunction with proposal EB97-04/05 which removed the section in A507 that referenced the tables. This chapter refers to the checklists in ASCE 31 based on the reference in A507.1.

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

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

EB50–07/08
Chapter A5

Proponent: David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

Revise as follows:

CHAPTER A5

EARTHQUAKE HAZARD REDUCTION IN EXISTING CONCRETE BUILDINGS ~~AND CONCRETE WITH MASONRY INFILL BUILDINGS~~

SECTION A501
PURPOSE

The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury that may result from the effects of earthquakes on concrete buildings and concrete frame buildings ~~with masonry infills~~.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with the provisions in this chapter will not necessarily prevent loss of life or injury or prevent earthquake damage to the rehabilitated buildings.

SECTION A502
SCOPE

The provisions of this chapter shall apply to all buildings having concrete floors or roofs supported by reinforced concrete walls or by concrete frames and columns ~~or to buildings having concrete frames with masonry infill~~. This chapter shall not apply to buildings with roof diaphragms that are defined as flexible diaphragms by the building code, and shall not apply to concrete frame buildings with masonry infilled walls..

Buildings that were designed and constructed in accordance with the seismic provisions of the 1993 *BOCA National Building Code*, the 1994 *Standard Building Code,* the 1976 *Uniform Building Code,* the 2000 *International Building Code* or later editions of these codes shall be deemed to comply with these provisions, unless the seismicity of the region has increased since the design of the building.

> **Exception:** This chapter shall not apply to concrete buildings ~~and concrete with masonry infill buildings~~ where Seismic Design Category A is permitted.

SECTION A503
DEFINITIONS

For the purposes of this chapter, the applicable definitions and notations in the building code and the following shall apply:

~~**MASONRYINFILL.** An unreinforced or reinforced masonry wall construction within a reinforced concrete frame.~~

SEISMIC USE GROUP III. Those buildings categorized as essential facilities or hazardous facilities, or as designated by the building official.

SECTION A504
SYMBOLS AND NOTATIONS

For the purposes of this chapter, the applicable symbols and notations in the building code and the following shall apply.

~~*Api* = Spectral acceleration ordinate of the trial performance point in the Acceleration-Displacement Response Spectra (ADRS) domain.~~
~~*A* = Spectral acceleration ordinate of the yield point of the capacity curve in the Acceleration-Displacement Response Spectra (ADRS) domain.~~
~~*Dpi* = Spectral displacement ordinate of the trial performance point in the Acceleration-Displacement Response Spectra (ADRS) domain.~~

~~*Dy* = Spectral displacement ordinate of the yield point of the capacity curve in the Acceleration-Displacement Response Spectra (ADRS) domain.~~
~~*PFI* = Participation factor for the first or primary natural vibration mode of the structure.~~
~~*Sa* = Spectral acceleration.~~
~~*Sd* = Spectral displacement.~~
~~*SRA* = Modification factor for the 5-percent damped acceleration response spectra in the constant acceleration region.~~
~~*SRV* = Modification factor for the 5-percent damped acceleration response spectra in the constant velocity region.~~
V = Total design base shear.
W = Total design seismic dead load as prescribed in the building code.
wi = Portion of *W* that is located at or assigned to level *i*.
~~*aLL* = Modal weight coefficient for the first or primary natural vibration mode of the structure.~~
~~*Droof* = Roof displacement relative to the ground.~~
~~*αI* = Modal weight coefficient for the first or primary natural vibration mode of the structure.~~
~~*φi,I* = The first or primary natural vibration mode shape coordinate at floor level *i* in the direction of the applied seismic loading, *Sa*.~~
~~*φroof,I* = The first or primary natural vibration mode shape coordinate at the roof level in the direction of the applied seismic loading, *Sa*.~~
~~*φi,j* = Displacement amplitude of floor level *i* in the *j*th natural vibration mode of the structure.~~
~~*Φroofj* = Displacement amplitude of the roof level in the *j*th natural vibration mode of the structure.~~

SECTION A505
GENERAL REQUIREMENTS

A505.1 General. This chapter provides a three-tiered procedure to evaluate the need for seismic rehabilitation of existing concrete buildings ~~and concrete buildings with masonry infills~~. The evaluation shall show that the existing building is in compliance with the appropriate part of the evaluation procedure as described in Sections A507, A508 and A509, or shall be modified to conform to the respective acceptance criteria. This chapter does not preclude a building from being evaluated or modified to conform to the acceptance criteria using other well-established procedures, based on rational methods of analysis in accordance with principles of mechanics and approved by the authority having jurisdiction. ~~Evaluation of concrete buildings with masonry infill shall be in accordance with Tier 3 analysis procedure as described in Section A509.~~

A505.2 Properties of in-place materials. Except where specifically permitted herein, the stress-strain relationship of concrete~~, masonry~~ and reinforcement shall be determined from published data or by testing. All available information, including building plans, original calculations and design criteria, site observations, testing, and records of typical materials and construction practices prevalent at the time of construction, shall be considered when determining material properties.

For Tier 3 analyses, expected material properties shall be used in lieu of nominal properties in the calculation of strength, stiffness and ~~deformabiltity~~ of building components.

The procedure for testing and determination of stress-strain values shall be ~~as prescribed in Sections A505.2.1 through A505.2.5~~ <u>from Section 6.2 of ASCE 41-06</u>.

~~**A505.2.1 Concrete.**~~
~~**A505.2.2 Solid-grouted reinforced masonry.**~~
~~**A505.2.3 Partially grouted masonry.**~~
~~**A505.2.4 Unreinforced masonry.**~~
~~**A505.2.5 Reinforcement.**~~

~~**TABLE A505.1—ASSUMED COMPRESSIVE STRENGTH OF STRUCTURAL CONCRETE (psi)**~~
~~**TABLE A505.2—ASSUMED YIELD STRESS OF EXISTING REINFORCEMENT (psi)**~~

A505.3 Structural observation, testing and inspection. (No change to current text)

SECTION A506
SITE GROUND MOTION
(No change to current text)

SECTION A507
TIER 1 ANALYSIS PROCEDURE
(No change to current text)

SECTION A508
TIER 2 ANALYSIS PROCEDURE

A508.1 General. (No change to current text)

~~**TABLE A508.1—COMPONENT STIFFNESS**~~

A508.2 Limitations. (No change to current text)
A508.3 Analysis procedure. (No change to current text))

A508.3.1 Mathematical model. The three-dimensional mathematical model of the physical structure shall represent the spatial distribution of mass and stiffness of the structure to an extent that is adequate for the calculation of the significant features of its distribution of lateral forces. All concrete ~~and masonry~~ elements shall be included in the model of the physical structure.

> **Exception:** Concrete or masonry partitions that are isolated from the concrete frame members and the floor above.

Cast-in-place reinforced concrete floors with span-to-depth ratios less than three-to-one may be assumed to be rigid diaphragms. Other floors, including floors constructed of precast elements with or without a reinforced concrete topping, shall be analyzed in conformance with the building code to determine if they must be considered semi-rigid diaphragms. The effective in-plane stiffness of the diaphragm, including effects of cracking and discontinuity between precast elements, shall be considered. Parking structures that have ramps rather than a single floor level shall be modeled as having mass appropriately distributed on each ramp. The lateral stiffness of the ramp may be calculated as having properties based on the uncracked cross section of the slab exclusive of beams and girders.

A508.3.2 Component stiffness. Component stiffness shall be calculated based on the approximate values shown in ~~Table A508.1~~ Table 605 of ASCE 41-06.

A508.4 Design, detailing requirements and structural component load effects. (No change to current text)
A508.5 Acceptance criteria. (No change to current text)
A508.5.1 Load combinations. (No change to current text)
A508.5.2 Determination of the strength of members. (No change to current text)

Delete all of Sections A509 and A510, and replace by the following single paragraph as A509.

~~SECTION A509~~
~~TIER 3 ANALYSIS PROCEDURE~~

~~SECTION A510~~
~~DETERMINATION OF THE STRESS-STRAIN RELATIONSHIP OF EXISTING UNREINFORCED MASONRY~~

SECTION A509
TIER 3 ANALYSIS PROCEDURE

A509 General. A Tier 3 evaluation shall be performed using the nonlinear procedures of Section 6.3.1.2.2. of ASCE 41-06. The general assumptions and requirements of Section 6.0, excluding Concrete Frames with Infills shall be used in the evaluation. Site ground motions per section A506.3 are permitted for this evaluation.

~~**TABLE A5-A—BASIC STRUCTURAL CHECKLIST**~~
~~**TABLE A5-B—SUPPLEMENTAL STRUCTURAL CHECKLIST**~~
~~**TABLE A5-C—GEOLOGIC SITE HAZARD AND FOUNDATION CHECKLIST**~~

Reason: To eliminate all reference in this chapter to Masonry Infilled frames; and to combine material properties and nonlinear procedures for concrete structures in Appendix Chapter A5 to be consistent with ASCE 41-06.

The proposed changes are an attempt to bring consistency with ACSE 41-06, and eliminate sections of A5 that are not substantiated by current research, specifically procedures for evaluation of concrete frames with infilled masonry walls.

The Tier 1 Checklists are also deleted because they create conflict with the ASCE 31 Checklist, and the existing checklists refer to sections that do not exist in the 2006 IEBC. This change is Errata.

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

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

EB51–07/08
Chapter A6

Proponent: John Kariotis, John Kariotis, Structural Engineer, representing Structural Engineers Association of California, Existing Buildings Committee

Add new chapter as follows: (**Underline not shown for ease of reading)**

CHAPTER A6
EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE FRAME BUILDINGS WITH UNREINFORCED MASONRY INFILL

SECTION A601
PURPOSE

The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury that may result from the effects of earthquakes on concrete frame buildings with unreinforced masonry infills.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with the provisions in this chapter will not necessarily prevent loss of life or injury or prevent earthquake damage to the rehabilitated buildings.

SECTION A602
SCOPE

The provisions of this chapter shall apply to all buildings having reinforced concrete frames with unreinforced masonry infill in Seismic Design Categories C, D, E and F

SECTION A603
DEFINITIONS

For the purposes of this chapter, the applicable definitions and notations in the building code and the following shall apply:

AXIAL HINGE. A plastic hinge defined to model the inelastic action of a structural member when its yield strength is exceeded due to axial forces.

AXIAL-MOMENT HINGE. A plastic hinge defined to model the inelastic action of a structural action of a structural member when its yield strength is exceeded due to combination of axial loads and flexural moments.

BUILDING TYPE. A building classification described in ASCE 31-03.

EXISTING INFILL DAMAGE. Damage experienced in the infill during its life.

FRAME. A structural system of beams and columns that resists vertical/lateral loading.

INFILL ASPECT RATIO. Ratio of full length to height dimensions for masonry infill panels (l / h).

INFILL SLENDERNESS RATIO. Ratio of full height to gross thickness dimensions for masonry infill panels (h / t).

INFILL STRENGTH. The maximum out-of-plane lateral load that a masonry infill panel can resist (psf.).

INFILLED FRAME. Lateral and vertical load resisting structural systems that consist of frame and infill panels. The infill can be full, partial, or contain openings.

ISOLATED CONCRETE AND MASONRY PARTITIONS. Partitions that have only their base in contact with the structure. The other three sides shall be isolated by a separation joint from structural elements.

MOMENT HINGE. A plastic hinge defined to model the inelastic action of a structural member when its yield strength is exceeded due to flexural moments.

MORTAR. A mixture of sand, lime, cement and water used to bond masonry units.

PARTIALLY INFILLED BAY. A partially infilled bay is an infill of window sill height and full bay length.

PEAK (ULTIMATE) LOAD. The maximum value of base shear predicted by a nonlinear structural pushover.

PLASTIC HINGE. Location of inelastic action in a structural member.

RIGID END OFFSET. The length of a structural member assumed to be completely rigid in order to model the effects of full contact between the infill and structural members.

SEISMIC USE GROUP III. Those buildings categorized as essential facilities or hazardous facilities, or as designated by the building official.

SHEAR HINGE. A plastic hinge defined to model the inelastic action of a structural member when its yield strength is exceeded due to shear forces.

UNREINFORCED MASONRY INFILL. An unreinforced masonry wall constructed within a reinforced concrete frame. These panels were built in place and should be constructed with full contact along their full perimeter.

YIELD LOAD. Value of base shear in a calculated pushover curve at which the tangent to the calculated slope of the curve changes and the element or system has a reduced stiffness.

SECTION A604
SYMBOLS AND NOTATIONS

For the purposes of this chapter, the applicable symbols and notations in the building code and the following shall apply.

a Equivalent width of infill strut in the elastic range (in.).
A_n Net cross-sectional mortar/grouted area of infill panel along its length (in.^{2}).
A_{open} Total area of openings in a selected infill panel (in.^{2}).
A_{panel} Gross area of an infill panel (in.^{2}).
C A multiplication factor for calculating strut width that accounts for aspect ratio.
D Diagonal length of infill (in.).
E_c Modulus of elasticity of reinforced concrete confining frame (psi).
E_m Modulus of elasticity of masonry in compression (psi).
f'_m Compressive strength of masonry (psi).
f'_v Masonry shear strength (psi).
H Height of confining frame measured between centerlines of beams (in.).
h Height of infill panel (in.).
h/t Infill panel slenderness ratio.
I_{beam} Moment of inertia of confining beam (in.^{4}).
I_{column} Moment of inertia of confining column (in.^{4}).
I_{frame} Least moment of inertia between values of I_{column} and I_{beam} (in.^{4}).
$IP_{capacity}$ Peak (ultimate) inplane load capacity of infilled frame (kips).
$IP_{reduced}$ Reduced inplane load capacity resulting from out-of-plane forces (kips).
K_e Effective lateral stiffness of the building in the direction of consideration (k/in.)
K_i Modified initial stiffness for a bilinear curve and used in procedures of Section 608 (k/in.).
$\mathrm{K_i}$ Elastic lateral stiffness of the building in the direction of consideration calculated using the material properties determined by experimental testing (k/in.).
K_f Modified post-yield stiffness for a bilinear curve and used in procedures of Section 608 (k/in.).
K_{SSC} Initial stiffness estimated from *Stafford-Smith and Carter* (1969) and used in procedures of Section 608 (k/in.).
K_y Initial stiffness estimated from *Mainstone* (1971) and used in procedures of Section A608 (k/in.).
K_u Post-yield stiffness estimated from *Mainstone* (1971) and used in procedures of Section 608 (k/in.).
l Length of infill panel (in.).
l/h Infill aspect ratio
l_{beam} Distance from edge of column to first beam plastic hinge (in.).
l_{column} Distance from face of beam to first column plastic hinge (in.).
OP_{demand} Out-of-plane design loading (kips).
$OP_{capacity}$ Out-of-plane loading that infill panel is capable of withstanding (kips).

R_{cr} Force required to reach the masonry infill panel's crushing strength (lb).
R_{shear} Force required to reach the infill panel's shear strength (lb).
R_{strut} Minimum of R_{cr} and R_{shear} (lb).
$(R_1)_i$ Inplane strength reduction factor that accounts for openings in infill panel.
$(R_1)_o$ Out-of-plane strength reduction that accounts for opening in infill panels.
$(R_2)_i$ Inplane strength reduction factor that accounts for existing panel damage.
$(R_2)_o$ Out-of-plane strength reduction factor that accounts for existing panel damage.
$(R_3)_o$ Out-of-plane strength reduction factor that accounts for flexibility of confining frame.
t Gross thickness of infill (in.).
t_{eff} Effective net thickness of infill (in.).
V_d Maximum base shear force calculated from nonlinear pushover; see Figure 3-1 of ASCE 41-06
V_y Estimated bilinear yield strength of structure using procedures of Section A608. (kips).
V_u Peak (ultimate) capacity of structure as calculated by pushover analysis in Section A608. (kips).
V_y Yield strength calculated using results of the NSP push-over procedure of Section A609 for the idealized nonlinear force-displacement curve of the building in accordance with Section 3.3.3.2.5 of ASCE 41-06.
w Parameter used in out-of-plane strength evaluation of masonry infill panels (psi).
α_1 Positive post-yield slope ratio equal to the positive post-yield stiffness divided by the effective stiffness , Fig. 3-1 Chapter 3, ASCE 41-06
α_2 Negative post-peak slope ratio equal to the negative post-yield stiffness divided by the effective stiffness, Fig. 3-1, Eq. 3-17, ASCE 41-06.
α_e Effective negative post-yield slope ratio equal to the effective post-yield negative stiffness divided by the effective stiffness, Eqs. 3-16, 3-17, ASCE 41-06..
τ_p Peak cohesive mortar joint shear stress determined by field testing (psi),
τ_r Residual mortar joint shear stress determined by field testing (psi).
Δ_u Bilinear deflection at peak (ultimate) load as calculated by pushover analysis (in.).
Δ_y Estimated bilinear "yield" deflection (in.).
Δ_y' Modified bilinear deflection at peak (ultimate) load (in.).
Δ_y' Modified bilinear "yield" deflection (in.).
λ_o Parameter required to evaluate out-of-plane infill strength.
λ Relative infill to frame stiffness parameter.
η Displacement amplifier, greater than one, to account for effects of torsion, Eq. 3-1 of ASEC 41-06.
θ Angle of concentric equivalent strut (degrees).
θ_{beam} Angle between face of eccentric equivalent strut and the horizontal if strut is modeled eccentrically on the beam (degrees).
θ_{column} Angle between face of eccentric equivalent strut and the horizontal if strut is modeled eccentrically on the column (degrees).
θ_{strut} Angle between eccentric equivalent strut and the horizontal if the strut is assumed to connect
l_{column} heights on columns (degrees).
δ_t Target displacement calculated in accordance with Section 3.3.3.3.2 of ASCE 41-06

SECTION A605
GENERAL REQUIREMENTS

A605.1 General. This chapter provides a three-tiered procedure to evaluate the need for seismic rehabilitation of existing reinforced concrete frame buildings with unreinforced masonry infill.

The evaluation shall show that the existing building is in compliance with the appropriate part of the evaluation procedure as described in Sections A607, A608, A609 and A610 or shall be modified to conform to the respective acceptance criteria.

A605.1.1 Review. The analysis, design, assumptions of material and system behavior. and conclusions shall be independently reviewed in accordance with Section 16.2,5 of ASCE 7.

Exceptions:

1. The jurisdiction may perform the review when qualified staff is available within the jurisdiction.
2. The Building Official may modify or waive the requirements for this review when appropriate.

A605.2 Properties of in-place materials. Except where specifically permitted herein, the stress-strain relationship of concrete, masonry and reinforcement shall be determined from published data or by testing. All available information, including building plans, original calculations and design criteria, site observations, testing, and records of typical materials and construction practices prevalent at the time of construction, shall be considered when determining material properties.

For Tier 3 analyses, expected material properties and strength values determined by testing shall be used in lieu of nominal material properties and strength values in the calculation of strength, stiffness and deformability of building components. The procedure for testing and determination of material properties and strength values shall be as prescribed in Section A611. Exceptions can be approved by the building official upon submittal of appropriate justifications. Material properties that are not covered by the testing procedures presented in Section 611 shall be determined from test methods or assumptions justified by published literature and approved by the building official. The use of these values shall be justified in the evaluation report.

A605.2.1 Concrete. The compressive strength, compressive modulus and tensile splitting strength of existing concrete shall be determined by tests on cores sampled from the structure.

Exceptions:

1. For Tier 1 analysis, the compressive strength of the concrete may be determined based on the information shown on original construction documents or based on the values shown in Chapter A5, Table A505.1.
2. For Tier 2 analysis, the compressive strength maybe determined based on the information shown on the original construction documents.

Core testing shall be performed in accordance with the following:

1. The cutting of cores shall not significantly reduce the strength of the existing structure. Cores shall not be taken in columns. Existing reinforcement shall not be cut.
2. If the construction documents do not specify a minimum compressive strength of the classes of concrete, five cores per story, with a minimum of 10 cores shall be obtained for testing.

   Exception: If the coefficient of variation of the compressive strength does not exceed 15 percent, the number of cores per story may be reduced to three and the minimum number of tests may be reduced to six.

3. When the construction documents specify a minimum compressive strength, two cores per story per class of concrete shall be taken in the areas where that concrete was to be placed. A minimum of five cores shall be obtained for testing. If a higher strength of concrete was specified for columns than the remainder of the concrete, cores taken in beams for verification of the specified strength of the beams shall be substituted for tests in the columns. The strength specified for columns may be used in the analyses if the specified compressive strength in the beams is verified. If the above conditions are not met, the compressive strength of concrete in the columns shall be estimated from nondestructive test methods.
4. The sampling for the concrete tests shall be distributed uniformly in each story of the existing seismic load-resisting frames. The cores shall be taken from the center of beams at mid-span.
5. The mean value of the compressive stresses obtained from the core testing for each class of concrete shall be used in the analyses. Value of peak strain associated with peak compressive stress may be taken from published data for the nonlinear analyses of reinforced concrete elements.

A605.2. Unreinforced masonry. The compressive strength, compressive modulus and peak compressive strain of the masonry shall be determined as specified in Section 611. The tensile splitting strength of masonry units shall be determined in accordance with ASTM C-1006-01 for Tier 3 analyses as specified in A611.The cohesive shear strength and residual shear strength of the mortar joints shall be determined as specified in Section A611. The material properties of masonry assemblies shall be determined as specified in Section A611. A minimum of one compressive strength, peak compressive strain and compressive modulus test per story in each line of seismic load resistance and a minimum of eight tests shall be made in the unreinforced masonry infills A minimum of four tests per story for cohesive shear strength and residual shear strength of mortar joints and a minimum of ten tests shall made in the unreinforced masonry infills. The location of the tests shall be uniformly distributed throughout the building.

The average of the material values and strengths obtained from testing shall be used in the nonlinear analyses of frame-infill assemblies.

A605.3. Reinforcement. The expected yield stress of each type of new or existing reinforcement shall be taken from Table 6-2 of ASCE 41-06, unless the reinforcement is sampled and tested for yield stress. The axial reinforcement in columns of pre-1933 buildings shall be assumed to be hard grade unless noted otherwise on the construction documents. Reinforcement with bar deformations not in conformance with ASTM A-408 shall be tested for development of a bond-slip model for Tier 3 analyses as specified in A611.3 for Tier 3 analyses.

A605.4 Structural observation, testing and inspection. Structural observation, in accordance with Section 1709 of the *International Building Code* shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for conformance with the approved construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new construction materials shall be in accordance with the building code, except as modified by this chapter.

SECTION A606
SITE GROUND MOTION

A606.1 Site ground motion for Tier 1 analysis. The earthquake loading used for the determination of demand on elements of the structure shall correspond to that required by ASCE 31-03 for Tier 1 analysis.

A606.2 Site ground motion for Tier 2 and 3 analysis. The site ground motion shall be the 5% damped elastic design response spectrum prepared in conformance with the building code but having spectral acceleration values equal to 75 percent of the code design response spectrum. The spectral acceleration values shall be increased by the occupancy importance factor when required by the building code.

SECTION A607
TIER 1 ANALYSIS PROCEDURE

A607.1 General. Structures conforming to building types C3 and C3A of ASCE 31-03 and satisfy the Tier 1 analysis procedure of ASCE 31-03 are permitted to be shown in conformance with this chapter by submission of a report to the building official. The Evaluation Report shall contain all items listed in Sections 3.7.10, 3.7.10S and Section 3.7.10A of ASCE 31-03 for the building type.

A607.2 Evaluation report. The registered design professional shall prepare a report summarizing the analysis conducted incompliance with this section. As a minimum, the report shall include the following items:

1. Building description.
2. Site inspection summary.
3. Summary of reviewed record documents.
4. Earthquake design data used for the evaluation of the building.
5. Completed checklists.
6. Quick-check analysis calculations.
7. Summary of deficiencies.

SECTION A608
TIER 2 ANALYSIS PROCEDURE

A608.1 General. A Tier 2 analysis of the existing reinforced concrete frames with unreinforced masonry infills satisfying the requirements of this section using nonlinear pushover analyses to develop bilinear force-controlled component force-versus-displacement curves at 75% of the code prescribed forces are deemed to comply.

The component force-versus-displacement curve is a Type 2 curve as shown in Chapter 2 of ASCE 41-06. The simplified nonlinear static (NSP) analysis (i.e. pushover), as specified in Section 3.3.3.2.2 of ASCE 41-06, is not permitted for the development of the bilinear Type 2 curve. The analysis of the existing seismic load-resisting system, an unreinforced masonry infilled concrete frame, must be completed in accordance with Section A608.3.2.9 to determine the initial stiffness, post-yield stiffness, yield strength and peak (ultimate) strength of the existing seismic load-resisting system prior to introducing supplemental strengthening elements into the combined system for reanalysis, The analysis, as a minimum, shall address all potential deficiencies identified in Tier 1, using procedures specified in this section.

If a Tier 2 analysis of the existing infilled frame lateral load-resisting system identifies a deficiency in the existing infilled frame condition, such deficiency may be modified to satisfy the acceptance criteria. Alternatively, the design professional may choose to perform a Tier 3 analysis to verify the adequacy of the structure.

A608.2 Limitations. Tier 2 analysis procedure may be used if:

1. There is no out-of-plane offset in the lateral-force-resisting system.
2. There is limited torsional irregularity present in any story. The maximum permitted torsional irregularity exists in a story when the maximum story drift, computed including accidental torsion, at one end of the structure transverse to an axis is more than 1.4 times the story drift at the opposite end of the structure.

3. There is no weak story irregularity at any floor level on any axis of the building. A weak story is one in which the story strength is less than 80 percent of that in the story above. The story strength is the total strength of all seismic-resisting elements sharing the story shear for the direction under consideration.
4. The building does not have a vertical mass or stiffness irregularity (soft story). Mass irregularity shall be considered to exist where the effective mass of any story is more than 150 percent of the effective mass of any adjacent story. A soft story is one in which the lateral stiffness is less than 70 percent of that in the story above or less than 80 percent of the average stiffness of the three stories above.
5. The building does not have a vertical geometric irregularity. Vertical geometric irregularity shall be considered to exist where the horizontal dimension of the lateral-force-resisting system in any story is more than 130 percent of that in an adjacent story.
6. The building does not have a non-orthogonal lateral-force resisting system.

A608.3 Analysis procedure. A structural analysis shall be performed for all concrete frame structures with unreinforced masonry infills in accordance with the requirements of ASCE 41-06 except as modified by Sections A608, A609, A610 and A611.

A608.3.1 Mathematical model. The mathematical model of the physical structure shall represent the spatial distribution of mass and stiffness of the structure to an extent that is adequate for the calculation of the significant features of its distribution of lateral forces to its lines of lateral-load resisting elements. All reinforced concrete elements in the lines of lateral load-resistance shall be included in the model of the structure. Concrete and masonry partitions that are isolated from the concrete frame members and the floor above shall not be considered as a part of the gravity or seismic load-resisting system.

Cast-in-place reinforced concrete floors with in-plane span-to-depth ratios less than three-to-one may be assumed to be rigid diaphragms. Other floors, including floors constructed of elements with or without a reinforced concrete topping, shall be analyzed in conformance with Section 3.2.4.2 of ASCE 41-06 to determine if they must be considered rigid, stiff or flexible diaphragms. The effective in-plane stiffness of stiff or flexible diaphragms including effects of probable stiffness degradation shall be considered.

A608.3.2 Nonlinear static model. The computational model of the building shall include all reinforced concrete frames and all unreinforced masonry infills in full panels, perforated panels and partially infilled bays in the reinforced concrete frames in lines of lateral load-resistance.

A608.3.2.1 Representation of unreinforced masonry infills. Equivalent struts that substitute for infilled masonry shall be placed in each infilled bay of the concrete frame. These equivalent struts shall be placed eccentrically with respect to the end of a column. The eccentricity is l_{column} and calculated by Equation (A6-1)

$$l_{column} = a/\cos\theta_{column} \tan\theta_{column} = [h - (a/\cos\theta_{column})] \div l \qquad \textbf{(Equation A6-1)}$$

Equivalent struts are assumed to be pinned at both ends to the confining frame. The strut thickness is the net thickness of the infill material it represents. The width of the equivalent strut is calculated by Equations (A6-2), (A6-3) and (A6-4) for infills having an aspect ratio (*l/h)* not less than *0.67* or greater than *1.5.*

$$\lambda H = H\,[(E_m t \sin 2\theta) \div (4\,E_c\,I_{col}\,h)]^{0.25} \qquad \textbf{(Equation A6-2)}$$
$$a = 0.175\,D\,(\lambda H)^{0.4} \qquad \textbf{(Equation A6-3)}$$
$$a_{red} = a\,(R_1)_i\,(R_2)_i \qquad \textbf{(Equation A6-4)}$$

where $(R_1)_i$ is given by Equation (A6-5) and $(R_2)_i$ in Table 6-1.

A 608.3.2.2 Representation of partially infilled bays and perforated panels. Partially infilled frames have an infill of window sill height and full bay length. The width of the equivalent strut, *a,* shall be calculated using sill height*, h*, in Equations (A6-2) and (A6-3). The l_{column} of the windward column shall be (*l-h*) and l_{column} of the leeward column is that specified in Section A608.3.2.1.

Perforated unreinforced masonry panels are considered to have an equivalent eccentric strut as specified in Section A608.3.2.1. The equivalent strut width shall be multiplied by a reduction factor. $(R_1)_i$. The reduction factor is calculated by Equation (A6-5).

$$(R_1)_i = 0.6\,(A_{open} \div A_{panel})^2 - 1.6\,(A_{open} \div A_{panel}) + 1.0 \qquad \textbf{(Equation A6-5)}$$

If the area of opening, A_{open}, is greater than 60% of the area of the infill panel, A_{panel}, the value of $(R_1)_i$ is zero.

A608.3.2.3. Existing infill damage. The extent of infill damage is determined by visual inspection of the masonry infill. Existing damage shall be classified as : No damage; Moderate damage if crack widths are 1/8 inch or less in X-pattern in infill; Severe damage if crack widths are greater than 1/8 inch in X-pattern in masonry infill. A strength reduction factor, $(R_2)_i$, shall be obtained from Table 6-1.

TABLE 6-1
IN-PLANE DAMAGE REDUCTION FACTOR
$(R_2)_i$ for Type of Damage

h/t	**Moderate**	**Severe**
≤21	0.7	0.4
› 21	Requires repair	Requires repair

If the slenderness ratio *(h/t)* is greater than 21, $(R_2)_i$ is not defined and repair is required. For panels with no existing damage, $(R_2)_i$ is 1.0.

A608.3.2.4 Plastic hinges in equivalent strut. The plastic hinge capacities of the equivalent strut, R_{strut}, are: the lesser of the bearing capacity of the strut on the concrete frame, R_{cr}, or R_{shear}, the diagonal stair-stepped shear strength of the masonry infill.

The crushing strength, R_{cr}, is calculated by Equation (A6-6).

$R_{cr} = a_{red}\, t_{eff}\, f'_m$ **(Equation A6-6)**

The shear strength of the infill panel is calculated by Equations (A6-7) and (A6-9)

$R_{strut} = R_{shear} / \cos\theta_{strut}$ **(Equation A6-7)**
$\tan\theta_{strut} = (h - 2l_{column}/2l)$ **(Equation A6-8)**
$R_{shear} = A_n f'_v\, (R_1)_i\, (R_2)_i$ **(Equation A6-9)**

The masonry shear strength, f'_v, shall be the residual shear strength, τ_r *as* defined in Section A611.4 and determined by field testing.

A608.3.2.5 Plastic hinge location in beams and columns. Plastic hinges in columns shall be located at l_{column} and account for the interaction between axial loads, moment capacity and shear strength. Plastic hinges in beams shall account for flexural behavior and be placed at l_{beam} from the face of the column. The distance, l_{beam}, is calculated by Equations (A608-10) and (A608-11).

$l_{beam} = a / \sin\theta_{beam}$ **(Equation A6-10)**
$\tan\theta_{beam} = h \div [l - (a / \sin\theta_{beam})]$ **(** **(Equation A6-11**)

A608.3.2.6 Rigid end offsets in moment frame. Rigid end offsets (REO) are required to represent the decreased flexibility of the moment frame members in contact with infill panels. The REO's shall extend outward from the joint by l_{column} in columns and l_{beam} in beams to a plastic hinge. Beams and columns at joints that are not in contact with infilled masonry shall not be modeled with REO's.

A608 3.2.7 Push-over procedure. The nonlinear model used in the pushover analysis must be able to capture the post-peak behavior of the system induced by the loss of plastic hinge capacities as a result of excessive deformation. Perform the nonlinear pushover to the lesser of 150% of the target displacement or the peak base shear capacity of the structure, V_u, that is calculated by the push-over made in accordance with this Section. The pushover is of each building height line of seismic resistance having unreinforced masonry infill panels in reinforced concrete frames. All components of the line of seismic resistance, reinforced concrete frames with and without unreinforced masonry infills, shall be included in the pushover analysis. The vertical distribution of pushover forces shall comply with Section A608.4.4. Plastic axial-moment and shear hinges shall be placed at l_{column} in the columns of the reinforced concrete frames in contact with masonry infill. Plastic moment and shear hinges shall be placed at l_{beam} in the beams of the reinforced concrete frames in contact with masonry infill. A plastic axial hinge shall be placed in the strut per A608.3.2.4. The capacity of the plastic hinge in the strut is the lesser of R_{cr} (Equation A6-6) or R_{shear} as modified by Equation A6-9. The pushover shall determine peak (ultimate) capacity of the building height line of seismic resistance and peak (ultimate) capacities of individual story heights of the line of seismic resistance. Two-directional loading cases shall be done to determine the least peak (ultimate) resistance due to configuration of components in the seismic load-resisting system.

Fit bilinear force-displacement curves to the calculated building and story height pushover force-displacement curves. The bilinear load-displacement curve is defined by three points: the origin, the "yield" load and displacement (V_y and Δ_y') and the peak (ultimate) load and displacement (V_u and Δ_u'). The "yield" load does not refer to any specific material yielding, but only to signify a change in stiffness represented by the calculated pushover load-displacement curve. The bilinear curve is represented by two stiffnesses, K_y and K_u, which are the slopes of the initial and final portions of the bilinear curve. The bilinear curve shall be drawn in a manner that minimizes the deviations from the calculated pushover curve. Modify the initial and post-yield stiffnesses determined by the pushover analysis as required by Section A608.3.2.8.

A608.3.2.8 Modification of bilinear load-deflection curve obtained by pushover. The modified initial and post-yield stiffnesses, K_i and K_f , to be used in the evaluation shall be obtained by modifying the K_y and K_u determined by the pushover analysis. The "yield" and peak (ultimate) loads are held constant while K_y and K_u are modified by Equations (A6-12), (A6-13 and (A6-14).

$K_i = 3K_y$ $(0.67 \leq l/h \leq 1.5)$ **(Equation A6-12)**
$K_i = K_{SSC}$ (any l/h) **(Equation A6-13)**

The modified post-yield stiffness, K_f is determined from K_u by Equation (A6-14)

$K_f = 2K_u$ **(Equation A6-14)**

Initial stiffness, K_{SSC}, is determined by use of Equations (A6-15), (A6-66) and (A6-17) for determination of width, *a,* of equivalent strut. The width of the equivalent strut may be calculated by Equations (A6-15), (A6-16) and (A6-17) for all values of *l/h* and shall be calculated by these Equations for aspect ratios less than 0.67 or greater than 1.5. The strut width calculated by Equations (A6-15), (A6-16) and (A6-17) is used for re-evaluation of linear stiffness only, not for calculation of strength of plastic hinges.

$a = 0.0835CD\,[1 + (2.574 \div \lambda_1 H)]$ for $l/h \geq 1.5$ **(Equation A6-15)**
$C = -0.3905\,(l/h) + 1.7829$ **(Equation A6-16)**
$a = 0.1106D\,[1 + (6.027 \div \lambda_1 H)]$ for $l/h = 1.0$ **(Equation A6-17)**

Linear interpolation is allowed for infill panel aspect ratios between 1.0 and 1.5. Extrapolation of this interpolation is permitted for all values of *l/h.*

A608.3.2.9 Force-controlled actions of supplemental systems. The pushover analyses, as modified by Section A608.3.2.8, of the existing lateral load-resisting systems provided by the infilled concrete frames shall precede analyses that include the resistance and stiffness of supplemental lateral load-resisting systems. The two systems, the existing infilled frame system and the supplemental system, are dual systems. As such; the resistance capacity obtained from the force-displacement curve of supplemental systems, at their common displacement is additive to the resistance capacity of the existing infilled concrete frame systems.

A608.4 Analysis procedure for acceptance of the existing infilled concrete frame structure. The acceptance of existing infilled concrete frame structures shall be determined by the criteria given in this Section.

A608.4.1 Conformance with the limitations of Section A608.2. Story level models of the structure shall be constructed with lines of seismic resistance on each orthogonal axis represented in plan at each story level. The eccentricities of mass and center of lateral resistance shall be determined for each orthogonal axis using initial stiffnesses, K_i of Section A608.3.2.8, of lines of seismic resistance at that story level. The actual torsional moment at a story shall be calculated by multiplying the seismic story shear force by the eccentricity between the center of mass and center of rigidity measured perpendicular of the direction of applied load. The center of mass shall be based on all floors above the story under consideration. The accidental torsional moment at a story shall be calculated as the seismic story shear force multiplied by a distance equal to 5% of the horizontal dimension at the given floor level measured perpendicular to the direction of applied load. If the ratio of displacements at the edges of the floor level parallel to the direction of seismic loading on one or both orthogonal axes exceeds 1.4, the structure does not conform to the limitations of Section A608.2 and a Tier 3 analysis procedure shall be used.

A608.4.2 Analysis procedure. The target displacement of the structure shall be calculated in conformance with Section 3.3.3.3.2 of ASCE 41-06. The target displacement shall be amplified for torsional effects as required by Section 3.2.2.2.2.6.2 of ASCE 41-06. The Simplified NSP Analysis. Section 3.3.3.2.2 of ASCE 41-06, shall not be permitted. The fundamental period of the structure shall be determined by the Section 3.3.1.2 of ASCE 41-06 and when required modified by Section 3.3.2.6 of ASCE 41-06. The nonlinear model used in the pushover analysis of the structure must be able to capture the post-peak behavior of lateral load-resisting systems induced by the loss of plastic hinge capacities as a result of excessive displacement. Perform the nonlinear pushover to the lesser of Δ'_u or 150% of target displacement in conformance with Section 3.3.3 of ASCE 41-06 as modified by this section. A two-dimensional model of the structure shall be subjected to increasing lateral loads until the lesser of 150% of the target displacement *or* Δ'_u is attained. The equivalent linear stiffness is determined by connecting a line from the origin to an intercept with the nonlinear portion of the load-displacement curve. The bilinear force-displacement curve shall be fit to the calculated push-over curve by balancing equal areas above and below the calculated push-over curve. The points used for construction of the nonlinear portion of the bilinear force-displacement shall correspond to the yield point (Δ_y' , V_y) and the lesser of the target displacement of the component and the displacement where a failure mechanism forms (V_u, Δ_u'). The analyses prescribed in this section shall include the effects of torsional irregularities permitted by Section A608.2..

A608.4.3 Gravity loads. Apply gravity loads as initial condition of pushover analysis. Load combinations are specified in Section 3.2.8 of ASCE 41-06. The gravity load on elements of the infilled frame shall be distributed between the horizontal cross section of the infill masonry wall and the reinforced concrete columns in accordance with their relative axial stiffnesses..

A608.4.4 Vertical distribution of seismic forces. Apply lateral loading to the building model as specified in Section 3.3.1.3.2 of ASCE 41-06. The vertical distribution of forces shall be proportional to its fundamental mode displaced shape in the direction of consideration.

A608.4.5 Acceptance criteria. The positive post-yield slope of the bilinear curve, K_u, shall be substituted for the $\alpha_1 K_e$ of Figure 3-1 of ASEC 41-06. The strength ratio, *R,* shall be determined in accordance with Equation 3-15 of ASCE 41-06. The bilinear force-displacement curve shall not have negative post-yield stiffness. If the post-yield stiffness is negative; the procedures of Section A609 shall be used.

If the calculated target displacement δ_t and its associated base shear V_u do not exceed the values of Δ_u', V_u of the infilled frame system is accepted.

If a Tier 2 analysis identifies a nonconforming condition in the pushover of the existing infilled frame system, the unreinforced masonry infill conditions may be modified to conform to the acceptance criteria of the infilled frame system. Alternatively, the design professional may choose to perform a Tier 3 procedure to verify the adequacy of the existing infilled system, or a supplemental lateral load-resisting system may be added to the existing infilled frame system. The lateral loading of the structure shall be assigned to the systems in accordance with their relative stiffnesses. A reanalysis of the systems shall be made to verify the adequacy of the supplemental lateral load-resisting system. The supplemental lateral load-resisting system shall not share above grade structural elements with the existing infilled frame system.

SECTION A609
TIER 3 ANALYSIS PROCEDURE

A609 General. A Tier 3 evaluation shall be performed using the procedures and analytical model prescribed in Section A609.1.

A609.1 Mathematical model. The computational model of the physical structure shall represent the spatial distribution of mass and stiffness of the structure to an extent that is adequate for the calculation of the significant features of its nonlinear dynamic response. All reinforced concrete frames with and without infilled unreinforced masonry panels shall be included in the model of the physical structure**,** Concrete and masonry partitions that are isolated from concrete frame members and floors above shall not be considered as a part of the gravity or seismic load-resisting system.

Cast-in-place reinforced concrete floors with in-plane span-to-depth ratios less than three-to-one may be assumed to be rigid diaphragms. Other floors, including floors constructed of elements with or without a reinforced concrete topping, shall be analyzed in conformance with Section 3.2.4.2 of ASCE 41-06 to determine if they must be considered rigid, stiff or flexible diaphragms. The effective in-plane stiffness of stiff or flexible diaphragms including effects of probable stiffness degradation shall be considered.

A609.1.1 Nonlinear static procedure model. The nonlinear static analysis shall be conducted with an analysis tool capable of utilizing linear and nonlinear material properties prescribed in Sections A609.2, A609.3 and A609.4 that are determined by engineering principles and in-situ testing as described in Section A611. The analysis tool shall be capable of capturing the general force-deformation characteristics of the system for all possible failure modes of the reinforced concrete frame and unreinforced masonry infill. The analytical tool and the methodology shall be validated and approved by the building official prior to submittal.

The modeling approach must be validated by simulation of published experimental data on concrete frames with unreinforced masonry infills. For this purpose, at least four tests with different structural parameters should be considered and compared with experimental damage and failure modes.. The parameters shall include: aspect ratio of infill, strength of the frame, shear strength and effective thickness of the unreinforced masonry infill. The validation results must be submitted to the building official as part of the evaluation report.

A609.2 Smeared crack model. The smeared crack model must be able to capture the nonlinear fracture behavior of concrete and masonry in tension and compression. One such model is a plasticity model with a strain-hardening/softening law to capture the nonlinear pre-peak and post-peak behavior of concrete and masonry. The plasticity model can be combined with a tension-cutoff criterion to signal the onset of cracking. A nonlinear orthotropic model can be used to model the behavior of concrete and masonry after tensile fracture. In either case, the model must be able to properly account for the fracture energy release of the material.

A609.3 Dilatant interface constitutive model. The model must be able to capture the tensile and shear fracture that may occur in a mortar joint as well as the Coulomb friction that provides the shear resistance after fracture. Since masonry is confined within the concrete frame and the frictional shear resistance is sensitive to the normal joint pressure, it is desirable to have a model that can account for the possible dilatation of a mortar joint under shear sliding. To simulate this behavior, a mortar joint including the masonry unit-mortar interface shall be modeled with a line interface element. The compressive behavior of an interface can be assumed linearly elastic or nonlinear elastic with hardening. The behavior of mortar joints in the elastic range and in the plastic range can be obtained by in-place cyclic testing as specified in Section A611.4.. The dilatancy effect on the mortar joint shear strength shall be estimated from the difference of the force measured on the first and second cycle of the in-place mortar joint testing described in Section A611.4 The testing of unreinforced masonry for elastic and plastic behavior and other material properties required for the nonlinear analysis is given in Section A611. For the analysis, it can assumed that the total axial gravity loading at each story-level be distributed among the masonry wall and the reinforced concrete columns in proportion to their relative axial stiffnesses.

A609.4 Bond-slip constitutive model. The deformations on archaic reinforcement commonly found in R/C frame building with URM infill are reduced in height, spacing and density from the deformations placed on modern reinforcement. An assumption of a perfect bond of reinforcement in cracked concrete would require an infinitely high strain in the reinforcement to account for a finite crack width and would prohibit a crack from opening. This may lead to the sensitivity of numerical results, such as the structural stiffness and ductility, to the mesh size. Nonlinear analyses show that the experimental load-displacement curve for a bare frame has better fit with a nonlinear simulation using bond-slip modeling. .

A609.5 Assembly of structural components into lateral load-resisting systems. The lateral load-resisting systems shall be vertical assemblies of story height assemblies. All existing components in the line of the lateral load-resisting system shall be included in the analyses. The existing structural system of reinforced concrete frames with unreinforced masonry infills on each line of lateral load-resistance shall be analyzed by the validated nonlinear static procedure specified in Section A609.1.1. Pushovers of the assembled components until 150% of its target displacement is attained shall be made of the following systems providing seismic resistance.

1. Each independent line of lateral load-resistance in its plane to its target displacement.
2. The two-dimensional representation of the total structure on each of the orthogonal axes.

The data obtained in these pushovers shall be: interstory load vs. displacement stiffnesses and global load vs. displacement stiffnesses of the full building height seismic load-resisting systems. The pushover procedure shall comply with Sections A609.6 and A609.7.

A609.6 Gravity loads. Apply gravity loading as an initial condition of the nonlinear analysis. Load combinations are specified in Section 3.2.8 of ASCE 41-06. The gravity load on elements of the infilled frames shall be distributed to the infill masonry and to the reinforced concrete columns in accordance with their axial stiffnesses.

A609.7 Vertical distribution of loading for pushover. The procedure of Section 3.3.1.2 of ASCE 41-06 shall be used for a preliminary period determination of the system. Apply loading to the specified computational model proportional to its fundamental mode displaced shape.

A609.8 Development of a trilinear load-displacement curve. A nonlinear finite element analysis following the guidelines specified in Section A609.1.1 is required to calculate a force-displacement relationship of lateral load-resisting systems. The lateral load-resisting systems of the structure shall be comprised of all reinforced concrete frames including bare frames, frames with partial infills, solid infills and infills with openings on each line of lateral resistance The trilinear load-displacement curve of the structure will have a plot similar to Figure 3-1 of ASCE 41-06.

The nonlinear force-displacement relationship between base shear and displacement of the control node shall be replaced with an idealized relationship to calculate the effective lateral stiffness, K_e, and effective yield strength, V_y, of the building as shown in Figure 3-1 of ASCE 41-06.

The first line segment of the idealized force-displacement curve shall begin at the origin and have a slope equal to the effective lateral stiffness, K_e. The effective lateral stiffness, K_e,, shall be taken as the secant stiffness calculated ar a base shear equal to 60% of the effective yield strength of the structure. The effective yield strength, V_y,, shall not be taken as greater than the maximum base shear force at any point along the force-displacement curve.

The second line segment shall represent the positive-yield slope (α_1, K_e) determined by a point (V_d, Δ_d) and a point at the intersection with the first line segment such that the areas above and below the actual curve are approximately balanced. (V_d, Δ_d) shall be a point on the actual force-at the calculated target displacement , or at the displacement corresponding to the maximum base shear, whichever is less.

The third line segment shall represent the negative post yield slope, (α_2, K_e) determined by the point end of the positive post-yield slope (V_d, Δ_d) and a point at which the base shear degrades to 60% of the effective yield strength.

A609.9 Analysis procedure for torsional response. Trilinear force-displacement curve as described in Section A609.8 shall be developed for each line of lateral load resistance. Planar computational models of each story level of the structure on each orthogonal axis shall be constructed with lines of lateral load-resistance represented in plan. The eccentricities of mass and center of lateral resistance shall be determined, using initial stiffnesses of the trilinear force-displacement curves developed in Section A609.8, for lines of lateral resistance on that axis and in that story level. The actual torsional moment at a story shall be calculated by multiplying the seismic story shear force by the eccentricity between the center of mass and center of rigidity measured perpendicular of the direction of applied load. The center of mass shall be based on all floors above the story under consideration. The accidental torsional moment at a story shall be calculated as the seismic story shear force multiplied by a distance equal to 5% of the horizontal dimension at the given floor level measured perpendicular to the direction of applied load. The torsional response shall be determined at each story level in accordance with Section 3.2.2.2.2 of ASCE 41-06 to calculate an amplification factor, η, of the target displacement.

A609.10 Acceptance criteria. The acceptance criterion is based on force-control. The displacement associated with the controlling force is determined by the validated finite element analyses of the seismic load-resisting systems on orthogonal axes of the two-dimensional computational model. The trilinear load-displacement curve constructed as specified in Section A609.8 into a configuration similar to Figure 3-1 of ASCE 41-06 is specified as the acceptance criteria. The target displacement shall be calculated in conformance with Section 3.3.3.2.6 of ASCE 41-06 and amplified by the factor, η, in accordance with Section 3.2.2.2.2 (6.2). The fundamental period of the structure shall be determined by Section 3.3.1.2.2 of ASCE 41-06 and modified by Section 3.3.2.6 of ASCE 41-06 for acceptance criteria. The required strength, V, shall be determined by Equation (3-9) of Section 3.3.1.3.3 of ASCE 41-06 if the slope of the second line of the trilinear force-displacement curve is positive slope. If the slope of the second line of the trilinear force-displacement is negative; R_{max}, Equation (3-16) of ASCE 41-06 must be determined and compared R, Equation (3-15). If $R \leq R_{max}$; NSL procedures are prohibited (Section 2.4.2.1 of ASCE 41-06) and the load-displacement curve of the lateral load-resistance of the structure must be altered.

If the slope of the second line of the trilinear force displacement curve is positive; the load point, V, calculated by Equation (3-9) of ASCE 41-06 and the target displacement, δ_t, calculated by Equation (3-14) of ASCE 41-06 and amplified by η calculated by Section 3.2.2.2.2 of ASCE 41-06, shall be plotted on the trilinear force displacement curve of the structure. If this point is below the first two lines of the trilinear force displacement curve; origin, (Δ_y -V_y), (Δ_d - V_d) the R/C frame with URM infill seismic load-resisting system is accepted.

SECTION A610
DETERMINATION OF OUT-OF-PLANE STABILITY OF EXISTING UNREINFORCED MASONRY INFILLS

A610.1 Scope. The provisions of this Section apply to analyses to determine the stability of unreinforced masonry walls when confined by reinforced concrete frames and subjected to out-of-plane loading. The demand loading on the infills shall be determined in accordance with ASCE 7-05. The demand seismic analysis force shall be 75% of that determined by Section 13.3 of ASCE 7-05. The coefficients a_p and R_p shall be taken as 1.0 and 1.5 respectively.

If the height-to-thickness ratio of the confined infill wall is equal to or less than those given in Table A1-B of Appendix Chapter A1 for unconfined unreinforced masonry bearing walls for the specified seismic risk; the stability analysis specified in Section A610 need not be made.

These provisions for determination of out-of-plane capacity (stability) of unreinforced infill walls are interlocked with the determination of in-plane capacities by a Tier 2 Analysis Procedure, Section 608. The analyses prescribed in that Section should be completed prior to conducting the analyses prescribed in this Section. If the nonlinear inplane demand (IP_{demand}) equals the maximum in-plane capacity ($IP_{cxapacity}$) calculated by Section A608, the OP_{demand} is reduced to 20% of $OP_{cxapacity}$. as calculated herein for an undamaged infill panel with Equation (A6-18).

A610.2 Calculations for out-of-plane resistance of unreinforced infills. The following conditions must exist for these calculations: the infill panel must be in full contact with its surrounding frame; the slenderness ratio, (*h/t*), of the panel must not exceed 25 and all confining beam and column elements have E_cI_{beam} and E_cI_{column} greater than 2 x 10^6 k-in^2.

The out-of-plane capacity of the infill wall is calculated by Equation (A6-18).

$w = [2f'_m\lambda_o \div (h/t)]\ (R_1)_o\ (R_2)_o\ (R_3)_o$ **(Equation A6-18)**

The units of *w* are the same as f'_m and *w* is assumed to be applied to the total area of the panel (including area of openings) to calculate the capacity in units of force.

A610.2.1 Load reduction factors. The capacity, *w*, is adjusted by the following load reduction factors; $(R_1)_o$, $(R_2)_o$, $(R_3)_o$. The factor, λ_o in Equation (A6-18) is related to the slenderness ratio, *h/t*. The relationship is given in Table 6-2.

TABLE 6-2
OUT-OF-PLANE SLENDERNESS PARAMETER

h/t	**5**	**10**	**15**	**20**	**25**
λ_o	0.129	0.060	0.034	0.021	0.013

A610.2.2 Effect of openings. The size and number of openings in an infill panel affect its strength and stiffness. The reduction factor, $(R_1)_o$ accounts for the effect of openings in the infill panel.

$(R_1)_o = 5/4\ [1 - (A_{open} \div A_{panel})]$ **(Equation A6-19)**

A610.2.3 Effect of existing damage. The reduction factor for existing damage, $(R_2)_o$, is given in Table 6-3. These tabular values depend on the level of existing damage and slenderness ratio, *h/t,* of the infill panel. If there is no existing damage, the reduction factor is 1.0.

TABLE 6-3
DAMAGE REDUCTION FACTORS
$(R_2)_o$ for Damage Level

h/t	**Moderate**	**Severe**
5	0.997	0.994
10	0.946	0.894
15	0.888	0.789
20	0.829	0.688
25	0.776	0.602

A610.2.4 Flexibility of frame elements. The smallest confining frame element must be checked for the minimum value of "confinement" index (2 x 10^6 k-in^2). For elements with an index greater than 2.0 x 10^6, the flexibility reduction factor, $(R_3)_o$, shall be determined by Equation (A6-20).

$(R_3)_o = 0.4 + 7.1^{-8}\ E_cI_{frame}$ **(Equation A6-20)**

Where: I_{frame} = lesser moment of inertia of I_{beam} or I_{column} (in.^{4}). For elements with E_cI_{frame} greater than $9.0x10^6$ $k\text{-}in^2$, or with infill continuity, $(R_3)_o$ is 1.0. Infill continuity is a condition when the beam or column has masonry infill on both sides of the beam or column. The end column of one or several infilled bays must be checked; the beam at the roof or below an open bay shall be checked.

A610.2.5 Effect of out-of-plane loading on inplane capacity. The inplane capacity of infilled frames will be reduced if large out-of-plane loads occur. Equation (A6-21) shall be used to determine the inplane capacity reduction. If the out-of-plane demand is less than or equal to 20 percent of out-of-plane capacity, inplane capacity is not reduced and Equation (A6-21) does not apply.

$IP_{reduced} / IP_{capacity} = 1 + [OP_{demand} \div (4\ OP_{capacity})] - [\ (5/4) \times (OP_{demand} \div OP_{capacity})^2]$ **(Equation A6-21)**

Where:

$IP_{reduced}$ is the inplane capacity considering out-of-plane loading.

$IP_{capacity}$ is the inplane capacity determined in accordance with Section A608.

OP_{demand} is the out-of-plane demand placed on the infill.

$OP_{capacity}$ is the capacity determined by the analyses in Section

SECTION A611
DETERMINATION OF MATERIAL PROPERTIES OF EXISTING CONCRETE AND UNREINFORCED MASONRY

A611.1 Scope. This section specifies procedures for determining material properties and strength values of existing concrete and unreinforced masonry used for seismic load-resisting systems.

A611.2 Concrete. Seventy-five percent of the cores obtained from the existing reinforced concrete frames shall be tested for compressive strength in accordance with ASTM C39. The compressive modulus of the existing concrete shall be obtained from one-half of the compressive strength tests. Twenty-five percent of the cores shall be tested for splitting tensile strength in accordance with ASTM 496.

A611.3 Reinforcement. Reinforcement bond properties and yield stress shall be determined for material properties to be used in nonlinear analyses as specified in Section A609, Tier 3 Analysis Procedure. Reinforcement in concrete frame members shall be exposed to determine deformation patterns. If the deformation pattern does not have equal spacing, or height of deformation or similarity to that specified for Billet type ASTM Grade 408, samples shall be taken from reinforced concrete in floor slabs or reinforced concrete joists. These specimens shall be tested to determine their bond strength due to chemical adhesion, effects of existing deformations, confining reinforcement, if any, and existing concrete cover. This data shall be used to develop a bond-slip relationship for input into the nonlinear analysis. A minimum of 4 tests of each non-conforming deformation pattern shall be made.

A611.4 Unreinforced masonry infills. The compressive strength and compressive modulus shall be determined from four-unit high prisms sampled from an exterior wythe of a multi-wythe masonry wall, or from prisms constructed of hollow units and mortar for a hollow masonry block wall. For infills of multi-wythe construction, the prisms shall be taken between header courses. Each prism shall be tested to determine compressive strength and compressive modulus. Compressive modulus shall be a line from the origin to 50% of maximum compressive stress. Peak compressive strain shall be determined from 25% of the prisms sampled.

The cyclic cohesive shear strength and residual shear strength of the existing mortar joints shall be determined by the following test procedure:

1. A single brick shall be isolated by removing a brick in the same course on each side of the brick to be tested for cohesive shear strength and residual shear strength. The mortar in the voids created shall also be removed.
2. Jacks shall be installed in each void. Bearing plates on the central brick shall not exceed the dimensions of this brick; bearing plates having the area of the void shall be installed at the opposite end of the jacks. The load of the jack applying force in the cyclic testing shall be plotted versus displacement of the loaded brick at displacement intervals of 0.1 mm.
3. The central brick shall be displaced 12 mm from the original position in each direction; the number of full cycles (right and left) shall be two. The total displacement of a full cycle shall be 24 mm.

The cohesive shear strength, τ_p, is the maximum force recorded divided by the area of the surfaces sheared. The residual shear strength, τ_r, is based on the force recorded in the post-peak cyclic testing. These values are specific for the axial stress at the test location. The axial stress is calculated as specified in Sections A609.3 and A609.5. Section A605.2 requires four tests per story; testing at the first story, mid-height and uppermost story will provide data for determining the effect of axial loading on mortar joint strength properties. This test procedure does not provide information on the compaction or dilatation of the mortar joint under cyclic shear reversals. The dilatancy effect on the post-cracked mortar joint shear strength can be estimated from the difference in force applied on the first cycle and second cycle. As an alternative, the finite element analysis may use a friction coefficient of 0.70 for old clay units having a 13 mm mortar joint thickness and mortar of 1 part Portland cement, 2 parts lime and 9 parts sand (1:2:9).

The tensile splitting strength of the existing masonry units shall be determined from masonry units removed from the infill panels for the cyclic shear tests. A minimum of 4 tests shall be made. The test procedure shall conform to ASTM C-1006 - 01.

Reason: The purpose of this addition to Appendix A of the 2009 Edition of the IEBC is the replace out dated material that has deleted from Appendix Chapter A5 of the 2006 IEBC. The justification for deletion of analysis and evaluation procedures for reinforced concrete frames with URM infill is that procedure now in Chapter A5 is ineffective for determining failure modes in the infill and in the reinforced concrete frame. The technical basis for the development of the A5 procedure for evaluation of R/C frames with URM infill was a successful replication of instrumental records (CSMIP) in frame buildings with URM infill. The A5 procedure tracked stiffness degradation but reevaluation found that it could not predict the many failure modes of infilled frames.

Appendix Chapter A6 provides two procedures for development of bilinear and trilinear envelope curves using nonlinear pushovers of the infilled frame system. These procedures are presented as Tier 2 and Tier 3 evaluations in Sections A608 and A609 of Chapter A6. The Tier 2 evaluation is for structures having restrictions on vertical and plan irregularities. The technical basis for the Tier 2 procedure is Reference[1]: Al-Chaar, G.,(Jan. 2002) "*Evaluating Strength and Stiffness of Unreinforced Masonry Infill Structures"* Construction Engineering Laboratory, Report ERDC/CERL, TR-02.1. The evaluation develops a bilinear envelope (Type 2, Figure 2.3 of ASCE 41-06) having yield and nonlinear force-displacement segments. An ultimate (peak) strength and stiffness relationship terminates the bilinear relationship. The Tier 3 evaluation is based on Finite Element Analysis Procedures to develop an envelope of a trilinear force-displacement curve such as shown in Figure 3.1 of ASCE 41-06. This trilinear force-displacement curve has an elastic segment, post-yield segment and post-peak strength segment. Acceptance of the systems represented by the bilinear and trilinear force-displacement curves is based on Section 3.3.3 Nonlinear Static Procedure of ASCE 41-06.

Experimental data given in Reference [2] Mehrabi, A. B.,Shing, P. B., Schuller, M. P., Noland, J. L.,(Oct. 1944) *Performance of Masonry-Infilled R/C Frames Under In-plane Lateral Loads,* Report CU/SR-94/6 shows that the R/C frame with URM infill has cyclic stiffness and strength degradation. Coefficient C_2 must be modified in conformance with Section C.3.3.1.3.1 for determination of the target displacement of the assembly. A minimum base shear of the assembly must be determined and the assembly will commonly be force-controlled.

The analysis tool used in Tier 3 evaluations must have capabilities described in Sections A609.1.1, A609.2, A609.3 and A609.4. The analysis tool must be validated by analysis of four experimental specimens that have published records of damage and failure modes. Section A605.1.1 requires peer review in accordance with Section 16.2.5 of ASCE 7 of the validation and simulation of experimental specimens. Reference [3], Mehrabi, A. B and Shing, P. B.(May 1997) *Finite Element Modeling of Masonry -Infilled R/C Frames,* ASCE Journal of Structural Engineering /May 1997 is an example of validation and simulation of experimental specimens.

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

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