2016 GROUP B PUBLIC COMMENT AGENDA

OCTOBER 19 - OCTOBER 25, 2016
KANSAS CITY CONVENTION CENTER
KANSAS CITY, MO
Proposed Change as Submitted

**Proponent**: Joseph Cain, SunEdison, representing Solar Energy Industries Association (SEIA) (joecainpe@aol.com)

**2015 International Existing Building Code**

Add new definition as follows:

**SECTION 202 DEFINITIONS**

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

Add new text as follows:

**SECTION 202 DEFINITIONS**

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

**SECTION 202 DEFINITIONS**

**PHOTOVOLTAIC PANEL SYSTEM.** A system that incorporates discrete photovoltaic panels, that converts radiation into electricity, including rack support systems.

**403.3.1.1 Live load at photovoltaic panel systems.** Where photovoltaic panel systems are to be installed over existing roofs, the roof live load need not be applied to the roof area covered by photovoltaic panels where the clear height between the photovoltaic panels and the roof is 42 in. (1067 mm) or less. In roof areas not covered by photovoltaic panels, live load shall be as specified in Section 403.3.1.

**403.3.2 Existing structural elements carrying photovoltaic panel systems** Where photovoltaic panel systems are installed on existing roof structures, structural elements that provide support for photovoltaic panel
systems shall be designed, or analyzed, in accordance with the *International Building Code* for deflection and ponding.

**403.12 Photovoltaic panel systems.** Design and installation of *photovoltaic panel systems* shall comply with this section, the *International Fire Code*, and *NFPA 70*.

**403.12.1 Roof live load.** Where *photovoltaic panel systems* are installed on existing buildings, roof live load shall be permitted to be offset according to Section 403.3.1.1.

**403.12.2 Snow load.** Where applicable, snow drift loads created by the *photovoltaic panel system* shall be considered in the analysis and design.

**403.12.3 Ballasted photovoltaic panel systems.** Ballasted, roof-mounted *photovoltaic panel systems* need not be rigidly attached to the roof or supporting structure. Ballasted nonpenetrating systems shall be designed and installed only on roofs with slopes not more than one unit vertical in 12 units horizontal. Ballasted nonpenetrating systems shall be designed to resist sliding and uplift resulting from lateral and vertical forces as required by the *International Building Code*, using a coefficient of friction determined by acceptable engineering principles. In structures assigned to Seismic Design Category C, D, E or F, ballasted nonpenetrating systems shall be designed to accommodate seismic displacement determined by *approved* analysis or shake table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for nonstructural components on roofs.

**807.3.1 Live load at photovoltaic panel systems.** Where *photovoltaic panel systems* are to be installed over existing roofs, the roof live load need not be applied to the roof area covered by *photovoltaic panels* where the clear height between the *photovoltaic panels* and the roof is 42 in. (1067 mm) or less. In roof areas not covered by *photovoltaic panels*, live load shall be as specified in Section 807.3.

**807.4.1 Existing structural elements carrying photovoltaic panel systems.** Where *photovoltaic panel systems* are installed on existing roof structures, structural elements that provide support for *photovoltaic panel systems* shall be designed, or analyzed, in accordance with the *International Building Code* for deflection and ponding.

**SECTION 808 PHOTOVOLTAIC PANEL SYSTEMS**
808.1 General. Design and installation of photovoltaic panel systems shall comply with this section, the International Fire Code, and NFPA 70.

808.2 Roof live load. Where photovoltaic panel systems are installed on existing buildings, roof live load shall be permitted to be offset according to Section 807.3.1.

808.3 Snow load. Where applicable, snow drift loads created by the photovoltaic panel system shall be considered in the analysis and design.

808.4 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure. Ballasted nonpenetrating systems shall be designed and installed only on roofs with slopes not more than one unit vertical in 12 units horizontal. Ballasted nonpenetrating systems shall be designed to resist sliding and uplift resulting from lateral and vertical forces as required by the International Building Code, using a coefficient of friction determined by acceptable engineering principles. In structures assigned to Seismic Design Category C, D, E or F, ballasted nonpenetrating systems shall be designed to accommodate seismic displacement determined by approved analysis or shake table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for nonstructural components on roofs.

Reason: This proposal is intended to introduce provisions for photovoltaic panel systems into the International Existing Building Code (IEBC) for the first time. Structural provisions first entered the International Building Code (IBC) in the 2012 edition. Additional structural provisions were added in the 2015 IBC and the 2015 International Residential Code. Still, the 2015 IEBC is silent on solar. In today’s market, the vast majority of rooftop solar installations are on existing buildings, so it is important to begin to include provisions in the IEBC. The provisions in this proposal should not be considered as all-inclusive, but should serve as a suitable introduction of photovoltaic panel systems into the IEBC.

The definitions proposed for IEBC Section 202 are based on the definitions already approved for the IBC and IRC. These definitions are consistent with NFPA 70, the National Electrical Code (NEC), with minor modifications. In this proposal, there is one deviation from the IBC and IRC (and NEC) definitions. In the definition of photovoltaic module, "DC power" (as occurs in IBC and IRC definitions) has been modified to "electricity," in recognition of innovation.
toward creating solar panels with integrated power electronics such that the panel produces AC power. In the IEBC, it is more important that the modules produce electricity than whether it is DC power or AC power.

In this proposal:

1. Sections 403.1.1 and 807.3.1 Live load are based on 2015 IBC Section 1607.12.5.1, with the exception of the height threshold for offset of live load. See separate discussion below for live load threshold.

2. Sections 403.3.2 and 807.4.1, including ponding check, are based on 2015 IBC Section 1607.12.5.4.

3. Sections 403.12 and 808.1 General are based on 2018 IBC Section 3111, as approved under ICC Group A development.

4. Sections 403.12.2 and 808.3 Snow load are based on 2015 IBC Section 1607.12.5.2.

5. Sections 403.12.3 and 808.4 Ballasted photovoltaic panel systems are based on 2015 IBC Sections 1607.12.5.4 and 1613.6.

If the reader is interested in the reason behind a 42 inch threshold for roof live load as opposed to the present 24 inch threshold in the 2015 IBC, additional information is provided below. This information is extracted from a parallel proposal to revise the IBC threshold.

This proposal seeks to revise the threshold for offset of live load from 24 inches to 42 inches. The Structural Engineers Association of California (SEAOC) PV Systems committee has conducted lengthy conversations on this topic, and is in agreement that 42 inches is a more reasonable threshold than 24 inches.

The following excerpt is from Recommended Design Live Loads for Rooftop Solar Arrays, by Colin Blaney, S.E. of ZFA Structural Engineers and Ron LaPlante, S.E. of the California Division of State Architect, Structural Safety (DSA SS):

The other significant question was whether or not live loads should be included under raised low to medium profile PV panel systems to account for either maintenance worker loads or other special loads. This would include loads such as storage, including temporary stacking of re-roofing materials. This question was discussed at length along with the term "inaccessible" that is used in DSA IR 16-8 and 2015 IBC Section 1607.12.5.1. The discussion
centered around whether it is meant to be used to identify the local space below a PV system or the entire roof top area that may be only "accessible" through a locked stair tower or hatch. After lengthy deliberations, the Task Group agreed to set a clear height cut off of 42". Under arrays taller than the cut off, uniform and concentrated live loads must be considered on the covered roof areas where the below-panel dimension exceeds this limit in addition to the uncovered areas. The 42" cut off is similar to uninhabitable attic spaces where storage loads need not be considered per 2012 IBC Table 1607.1 footnotes i & j. The Task Group also felt that it would be highly unlikely that any building owners or maintenance workers would store items of any significance below such systems as they would be exposed to the weather and could easily block roof drainage. It was also agreed that the term "inaccessible" should not apply to general roof access when discussed in context of eliminating roof live loads from consideration.

Footnotes i and j of 2015 IBC Table 1607.1 read as follows:

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

j. Uninhabitable attics with storage are those where the maximum clear height between the joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.

This proposal strives to establish a reasonable threshold for live load. Roof live load is defined as: "A load on a roof produced: 1) During maintenance by workers, equipment and materials; 2) During the life of the structure by movable objects such as planters or other small decorative appurtenances that are not occupancy related; 3) By the use and occupancy of the roof such as for roof gardens or assembly areas." In this definition, item 1 is most relevant for the space beneath photovoltaic panel systems. It is unlikely a person will be beneath a photovoltaic panel system for maintenance if the clear vertical height is 24 inches or less. This would require a maintenance worker to slide under the panels on back or belly, and would not allow
working space. It is more reasonable to assume a person could be beneath the system for maintenance if the clear vertical height is 42 inches or greater.


Cost Impact: Will not increase the cost of construction
This proposal will not increase the cost of construction, as it is intended to harmonize the IEBC with structural provisions already established in the IBC.

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The committee believes that the IBC already has requirements that the IEBC directs you to so there is no reason to add the proposed provisions for photovoltaic panels to the IEBC at this time. In addition there was not sufficient justification given for a 42 inch clear height rather 24 inches and equating this space to an attic is not appropriate. It was felt that the number of floor modifications presented indicates the need for the code change proponent to work out a more mutually agreeable solution in the public comment phase.

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

Proponent: Joseph Cain, representing Solar Energy Industries
Association (SEIA) (JoeCainPE@gmail.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

403.3.1.1 Live load at photovoltaic panel systems. Where photovoltaic panel systems are to be installed over existing roofs, the roof live load need not be applied to the roof area covered by photovoltaic panels where the clear height between the photovoltaic panels and the roof is 42 24 in. (1067 610 mm) or less. In roof areas not covered by photovoltaic panels, live load shall be as specified in Section 403.3.1.

807.3.1 Live load at photovoltaic panel systems. Where photovoltaic panel systems are to be installed over existing roofs, the roof live load need not be applied to the roof area covered by photovoltaic panels where the clear height between the photovoltaic panels and the roof is 42 24 in. (1067 610 mm) or less. In roof areas not covered by photovoltaic panels, live load shall be as specified in Section 807.3.

Commenter's Reason: The Solar Energy Industries Association (SEIA) recommends Approval As Modified by this Public Comment. We created proposal EB2-16 at the urging of structural engineers who insist that the International Building Code is for new construction only, and that any provisions for existing buildings should be included in the IEBC. Provisions specific to solar photovoltaic panel systems first entered the IBC and IFC with the 2012 edition. Many improvements and additional provisions were successful in the 2015 IBC and IFC, and new provisions were included in the 2015 IRC. Even though the majority of new rooftop installations of photovoltaic panel systems occur on existing buildings, the 2015 IEBC is still silent. If EB2-16 is disapproved, the IEBC will continue to be silent on solar photovoltaic systems for another cycle. We seek AMPC for EB2-16 such that guidance can be found in the IEBC.

To respond to comments from the Committee, the live load threshold in Sections 403.3.1.1 and 807.3.1 are reduced from 42 inches to 24 inches. These are the only modifications in this Public Comment.
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

301.1 General. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 301.1.1 through 301.1.3 as selected by the applicant. Sections 301.1.1 through 301.1.3 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 301.1.4 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 907.4.4. 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 701.3.

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. New structural members added as part of the alteration shall comply with the International Building Code. This exception shall not apply to alterations that constitute substantial improvement in flood hazard areas, which shall comply with Section 701.3. This exception shall not apply to the structural provisions of Chapter 4 or to the structural provisions of Sections 707, 807, and 907.

Reason: This proposal retains the exception that allows the code official to
waive certain architectural and other requirements that the IEBC would normally trigger in alteration projects. It removes that exception, however, regarding structural provisions.

The current exception already does not apply to alterations in flood hazard areas (which sometimes trigger structural improvements) or to substantial structural alterations. So the proposal does not change those cases at all.

Since the existing structural provisions for alterations are already measured, already allow reduced loads and alternative criteria in many cases, and already trigger structural improvements only in rare and severe cases, the proposed change to this exception should have little impact except to affirm that structural safety is fundamental to the code's intent.

By rolling back the blanket waiver for structural safety issues, the proposal helps code officials enforce the code as intended. It prevents the IEBC's basic structural requirements from being undermined by a permit applicant's pressure to receive a discretionary waiver.

As a secondary matter, it is worth noting that the existing exception is unclear. It refers to "laws in existence at the time the building ... was built." But if the intent is to waive requirements triggered by alterations, this language ignores, or forgets, the fact that older codes for a long time had alteration provisions that triggered structural upgrade -- often with requirements more onerous than those in the current IEBC. So does a permit applicant claiming compliance with the "laws in existence" a generation ago also intend to comply with those outdated triggers? Thie proposal removes that potential confusion.

Cost Impact: Will not increase the cost of construction

This proposal will not increase the cost of construction, but it could, hypothetically, limit the cases in which the code official could effectively reduce the cost of construction by waiving structural safety requirements. In practice, no increase in the cost of construction should be expected, however, since the proposal does not change any of the code's provisions, but only changes what was a discretionary waiver.
Committee Action: Approved as Submitted

Committee Reason: For consistency with Group A efforts toward converting IEBC to one compliance method. This is a step towards that convergence.

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

Proponent: Matt Archer, City of Lone Tree, Colorado, representing Colorado Chapter of the ICC (Matt.archer@cityoflonetree.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

301.1 General. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 301.1.1 through 301.1.3 as selected by the applicant. Sections 301.1.1 through 301.1.3 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 301.1.4 regardless of which compliance method is used.

Exceptions:

- 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. New structural members added as part of the alteration shall comply with the International Building Code. This exception shall not apply to alterations that constitute substantial improvement in flood hazard areas, which shall comply with Section 701.3. This exception shall not apply to the structural provisions
of Chapter 4 or to the structural provisions of Sections 707, 807, and 907.

1. 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. This exception shall not apply to:
   1.1. Alterations that constitute substantial improvement in flood hazard areas, which shall comply with Section 701.3.
   1.2. The structural provisions of Chapter 4 or to the structural provisions of Sections 707, 807, and 907.

2. New Structural members added as part of the alteration shall comply with the International Building Code.

Commenter's Reason: This is just a cleanup of the exception for 301.1. I do not intend to change the content or intent of the original proposal. More just a cleanup for further clarity and ease of use.

As you read the exception, there are really two exceptions and two exceptions to the exception in the body of the language as it exists. It's confusing just trying to explain it. I broke out the exceptions individually and sub exceptions as they apply, follow existing code format patterns found in the I-Codes (See section 1104.4 IBC as an example I used to reformat this exception).
Proposed Change as Submitted

Proponent: Matthew Senecal, American Concrete Institute, representing American Concrete Institute (matthew.senecal@concrete.org)

2015 International Existing Building Code

Add new text as follows:

301.1.5 Concrete evaluation and design procedures

Evaluation and design of structural concrete shall be in compliance with this code and ACI 562, except for seismic evaluation and design which shall be in compliance with Section 301.1.4.

Reference standards type: This reference standard is new to the ICC Code Books

Add new standard(s) as follows:

ACI

562-16 Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures

Reason: The American Concrete Institute (ACI) is proposing to add ACI 562-16, Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures, as a new reference standard for the International Existing Building Code (IEBC). In 2006, the repair industry approached ACI asking for a concrete repair and rehabilitation code that would improve the overall quality of concrete repairs by establishing common requirements and establish clear responsibilities between owners, designers, and contractors. This code would also provide building code officials with a reference by which to evaluate rehabilitated concrete structures. ACI assembled a code committee with balanced representation and produced the first official code in 2013. The committee has received feedback from users of the code and have released this second version of the code, ACI 562-16. ACI 562-16 complements the IEBC by providing specific direction on how to design concrete repairs and how to handle the unique construction problems associated with repair. This standard helps the designer assess the existing structure in accordance with the IEBC. The standard then provides the requirements that bridge the inconsistencies and gaps in acceptable criteria.
that occur from the two following situations that a designer must solve: one, repairing a structure according to the original building code used at the time it was built using current construction methods and materials; or, repairing a structure built according to an older building code but repaired according to the current building code. Note that ACI 562 does not address the evaluation of lateral-force resisting systems in high seismic areas. ASCE 41 is the appropriate referenced standard for this situation.

There are many benefits that ACI 562 provides for the designer, owner, contractor, and building code official. A few of these benefits are:

- Provides clearly defined, uniform requirements aimed at extending the service life of existing structures.
- Improves the efficiency, safety, and quality of concrete repair.
- Establishes clear responsibilities between owners, designers, and contractors.
- Provides building code officials with a means to evaluate rehabilitation designs.
- Provides specific repair requirements that often result in less costly repairs compared to repairs required to meet only new construction requirements.

Also, there are many resources that complement ACI 562. The "Guide to the Code for Evaluation, Repair, and Rehabilitation of Concrete Buildings," is available which provides greater understanding and case studies demonstrating its ease of use. Numerous technical notes, reports, guides, and specifications that provide background information and technical support are available through organizations, such as ACI, ASCE, BRE, CS, ICRI, NACE, PTI, RC, SSPC, and USACE. Many of these organizations publications related to concrete repair can be found in the Concrete Repair Manual.

Cost Impact: Will not increase the cost of construction
The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The end result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options. A case study that illustrates this point is provided below:
"ACI 562 has been used by Denver-based J. R. Harris & Company as a standard in assessing damages in existing concrete structures. As an approved consensus standard, according to American National Standards Institute (ANSI) procedures, ACI 562-13 has been accepted as the source standard to use for damage assessment and repair on individual projects by Greenwood Village and Pikes Peak Regional Building Departments in Colorado. Based on this acceptance, the consulting engineer was able to cite the code in their recommendation for structural remediation and determination of damages.
By applying the lesser of the demand to capacity ratio required by the original building code or the current building code, the costs to correct faulty construction were lower than if they are set strictly by current code requirements. In one case involving rehabilitation work on four buildings with faulty construction, J. R. Harris was able to reduce the repair costs from $12 million to $3 million, with a repair plan based on the lesser of the demand-capacity ratio based on either the original or current building code per ACI 562."

Analysis: A review of the standard(s) proposed for inclusion in the code, ACI 562, with regard to the ICC criteria for referenced standards (Section 3.6 of
CP#28) will be posted on the ICC website on or before April 1, 2016.

**Public Hearing Results**

**Committee Action:** Disapproved

**Committee Reason:** There is an apparent lack of coordination between the proposed referenced standard and the IEBC. It is not clear that it contains criteria that assists the building official. The provisions seem to be confusing and hard to enforce. There is a requirement for a design basis report that would usually be a matter for the designer and building owner to agree on. There is disagreement with the cost impact and a belief that costs will increase, particularly on smaller projects. Even without adding this new standard to the IEBC, it can still be used as an alternative method of design.

**Assembly Action:** None

**Individual Consideration Agenda**

**Public Comment 1:**

Proponent: Matthew Senecal, representing American Concrete Institute (matthew.senecal@concrete.org) requests Approve as Modified by this Public Comment.

Modify as Follows:

**2015 International Existing Building Code**

301.1.5 Concrete evaluation and design procedures Evaluation and design of structural concrete shall be in compliance with Except where this code and ACI-562, except for seismic evaluation and design which retrofit is required, in addition to the requirement of this code, ACI 562 shall be in compliance with Section 301.1.4 permitted for the evaluation and repair of existing structural concrete.

**Commenter's Reason:** A floor modifications was put forward by the National
Council of Structural Engineers Associations to alter this code change proposal from mandatory to optional. This public comment puts forward that option which would provide a greater acceptance by the design community. The American Concrete Institute is greatly concerned that there are no requirements available to the registered design professional, building code official, or owner that want to rely on consensus information related to the repair of concrete. There are no standards that deal with problem of applying present repair materials to existing concrete structures. The IEBC limits repair materials to those approved by the applicable code for new construction, hence it prohibits the use of newly developed FRP materials. ACI allows the use of these materials in accordance with industry standards. Since ACI 562 is the only code that deals with the direct repair of concrete, it becomes the current standard of care for the industry.

The follow is in response to the comments from the Committee Action Hearing:

- There are concerns with the coordination with IEBC. The main concern was that a few definitions from the IEBC were adjusted in the proposed standard. This is true but ACI does not believe that the exact definition must be used. Definitions may need to be further refined when applied to specific information. In this case, the consensus opinion was that more information was necessary. If adopted as an optional standard, this should not be an issue.
- There is concern that this difficult to understand. A new standard requires education to the community. ACI has been providing educational on this code for three years and will continue this educational effort for many more years. Once again as an optional standard, this standard will be of benefit for those take the opportunity to take this education.
- There is a concern about requiring a design basis report by the designer. The IEBC currently requires an evaluation report for the building official. The ACI 562 provision expands upon the existing requirement to protect the owner. The owner should have the right to know the extent of the repair being provided the designer. This requirement has precedence in the State of Massachusetts.
- There is concern that this can increase the cost of construction. This standard increases the opportunity to use the original building code to complete the repairs. The assumption from this proponent is that this
results in an overall lower cost than having to meet the latest code.

- The final statement is that standard may still be used according to the alternative method of design provisions of the IEBC. This is true and ACI has already been educating designers, building code officials, and owners in all fifty states. Being as ACI 562 is the standard of care for the repair of concrete, it is reasonable to have ACI 562 acknowledged in the IEBC.
Proposed Change as Submitted

Proponent: Gwenyth Searer, Wiss, Janney, Elstner Associates, Inc.

2015 International Existing Building Code

Add new text as follows:

SECTION 303 In-Situ Load Tests

303.1 General. In-situ load tests shall be conducted in accordance with Section 1708 of the International Building Code.

Reason: The in-situ load test provisions in the IBC are used for both new and existing buildings. The IEBC does not currently contain provisions for load tests of existing buildings but needs to, as in-situ load testing is a valid means of assessing an existing structure's or an existing component's strength. This reference to the IBC incorporates the test provisions in the IBC without requiring duplication of the provision. This is a cleaner solution that trying to copy the text from the IBC and then modifying it to fit within the structure of the IEBC, which has its own requirements for analysis as well as repair and hazard mitigation.

Cost Impact: Will not increase the cost of construction

This proposal has no cost implications, as the provisions in IBC Section 1708 were already intended to apply to both new and existing buildings. This proposal simply clarifies that the in-situ load test provisions of IBC Section 1708 can still be used to assess existing structures.

Committee Action: Approved as Submitted

Committee Reason: This committee agreed that the proposal corrects an omission by adding a necessary reference to IBC in-situ testing criteria.
Individual Consideration Agenda

Public Comment 1:

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

303.1 General. In-situ Where used, in-situ load tests shall be conducted in accordance with Section 1708 of the International Building Code.

Commenter's Reason: This comment offers a (perhaps overly cautious) clarification to the approved proposal. In order to avoid an incorrect inference that all existing building projects require in-situ load tests, we propose adding the two words as shown.
EB16-16

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

301.1 General. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 301.1.1 through 301.1.3 as selected by the applicant. Sections 301.1.1 through 301.1.3 shall not be applied in combination with each other except where specifically prescribed. 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 301.1.4 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 907.4.4. 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 701.3.

Delete and substitute as follows:

[BS] 402.3 Existing structural elements carrying gravity load. Structural Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by the International Building Code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased shall be considered an altered element subject to the requirements of Section 403.3. Any existing element that will form part of the lateral load path for any
part of the addition shall be considered an existing lateral load-carrying structural element subject to the requirements of Section 402.4. All work shall comply with the structural provisions of Section 1103.

Delete without substitution:

**[BS]-402.3.1 Design live load.** Where the addition does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition. If the approved live load is less than that required by Section 1607 of the *International Building Code*, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition does result in increased design live load, the live load required by Section 1607 of the *International Building Code* shall be used.

**[BS]-402.4 Existing structural elements carrying lateral load.** Where the addition is structurally independent of the existing structure, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the addition is not structurally independent of the existing structure, the existing structure and its addition acting together as a single structure shall be shown to meet the requirements of Sections 1609 and 1613 of the *International Building Code*. For purposes of this section, compliance with ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table 301.1.4.1 for the applicable risk category, shall be deemed to meet the requirements of Section 1613.

- **Exception:** Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is no more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *International Building Code*. For purposes of this exception, 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.
Reason: This proposal follows the precedent set by several proposals approved in Group A and simplifies the process of reconciling structural provisions between the Prescriptive and Work Area methods. The proposal eliminates duplication and inconsistency.
In brief: Just use the Work Area method's structural provisions. There is no reason why the structural provisions of the two methods should be different. In fact, in nearly all cases, the structural provisions are already nearly identical. Where they differ slightly, the Work Area method's provisions are generally preferred, and other small differences will be reconciled through separate proposals.
As a result of proposals approved in Group A, using the IEBC will no longer be as simple as 1. Pick your method, 2. Find your project type. In 2018, the steps will be more like 1. Find your project type, 2A. For some projects, go to a specific chapter, or 2B. For some projects, pick your method, and 3. If you have multiple project types (like an Alteration being done together with a Repair), do both 2A and 2B. Specifically:

- Due to EB 10, all methods will use the same provisions for Repairs.
- Due to EB 11, all methods will use the same provisions for Relocations.
- Due to EB 33, all methods will use the same provisions for Accessibility, setting the precedent for reconciling one discipline independent of method or project type.
- For Additions, Alterations, and Change of Occupancy you will still have to get to pick a method.
- There are even new provisions that cross reference between methods. EB 68, for example, added provisions to the Prescriptive and Performance methods that require compliance with Section 1106 within the Work Area method.

With these new precedents, there is no longer any reason to painstakingly revise two different methods if they can more easily be reconciled by a simple cross-reference, as proposed.

Cost Impact: Will increase the cost of construction
A significant cost increase is unlikely but possible, as there are some small differences between the two methods. Some might increase the cost, and
some might decrease the cost.

**Public Hearing Results**

**Committee Action:** Approved as Submitted

**Committee Reason:** Approval of this code change is a good step towards consolidating the requirements of the prescriptive and work area methods in the IEBC. Doing so eliminates confusion by getting rid of duplication and inconsistencies in the current provisions.

**Assembly Action:** None

**Individual Consideration Agenda**

**Public Comment 1:**

**Proponent:** Jonathan Siu, representing City of Seattle Department of Construction and Inspections (Jon.Siu@seattle.gov); Maureen Traxler, representing City of Seattle Dept of Construction & Inspections (maureen.traxler@seattle.gov) requests Approve as Modified by this Public Comment.

**Modify as Follows:**

2015 International Existing Building Code

**[BS] 402.3 Structural** All work shall comply with the structural provisions of Section 1103 303.

**CHAPTER 11 ADDITIONS**

1103 303 1103 303 STRUCTURAL--ADDITIONS

**[BS] 1103.1 303.1 Compliance with the International Building Code.** No change to text.

**[BS] 1103.2 303.2 Additional gravity loads.** Existing structural elements supporting any additional gravity loads as a result of additions 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 the *addition* comply with the conventional lightframe construction methods of the *International Building Code* or the provisions of the *International Residential Code*.

**[BS] 1103.3 303.3 Lateral force-resisting system.** The lateral force-resisting system of *existing buildings* to which additions are made shall comply with Sections 1103.3.1 303.3.1, 1103.3.2 303.3.2 and 1103.3.3 303.3.3.

**Exceptions:**

1. Buildings of Group R occupancy with no more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the *addition* comply with the conventional light-frame construction methods of the *International Building Code* or the provisions of the *International Residential Code*.
2. Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is not more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of this exception, 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. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations involving *International Building Code*-level seismic forces in accordance with Section 301.1.4.1.

**[BS] 1103.3.1 303.3.1 Vertical addition.** *No change to text.*

**[BS] 1103.3.2 303.3.2 Horizontal addition.** *No change to text.*

**[BS] 1103.3.3 303.3.3 Voluntary addition of structural elements to improve the lateral force-resisting system.** *No change to text.*
[BS] **1103.4 303.4 Snow drift loads.** Any structural element of an existing building subjected to additional loads from the effects of snow drift as a result of an addition 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 the addition comply with the conventional lightframe construction methods of the International Building Code or the provisions of the International Residential Code.

[BS] **1103.5 303.5 Flood hazard areas.** Additions and foundations in flood hazard areas shall comply with the following requirements:

1. For horizontal additions that are structurally interconnected to the existing building:
   1.1. If the addition and all other proposed work, when combined, constitute substantial improvement, the existing building and the addition shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.
   1.2. If the addition constitutes substantial improvement, the existing building and the addition shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

2. For horizontal additions that are not structurally interconnected to the existing building:
   2.1. The addition shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.
   2.2. If the addition and all other proposed work, when combined, constitute substantial improvement, the existing building and the addition shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.
3. For vertical additions and all other proposed work that, when combined, constitute substantial improvement, the existing building shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

4. For a raised or extended foundation, if the foundation work and all other proposed work, when combined, constitute substantial improvement, the existing building shall comply with Section 1612 of the International Building Code, or Section R322 of the International Residential Code, as applicable.

5. For a new foundation or replacement foundation, the foundation shall comply with Section 1612 of the International Building Code or Section R322 of the International Residential Code, as applicable.

**Commenter's Reason:** This comment moves the structural requirements for all additions to chapter 3. It makes no substantive changes to the original proposal, and is consistent with the intent of the original proposal. As detailed in the reason for the proposal, provisions that are the same for all projects are being located in Chapter 3, which is titled "Provisions for All Compliance Methods." With the original proposal, an applicant who is using the Prescriptive Method would be required to go to the Work Area Method for just the one subject of structural requirements for additions. If this comment is approved, the applicant would go to chapter 3 for many provisions, and would look at chapter 4 for everything else.
EB19-16
IEBC: 403.3.2 (New).

Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Add new text as follows:

403.3.2 Construction loads during reroofing. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

Reason: This proposal reconciles a difference between the Prescriptive and Work Area methods. The proposals adds matching language from 706.2 to 403.3. In concept, perhaps neither provision is needed if Chapter 15 is deemed adequate, but if 706.2 is retained, then 403.3 should have a matching provision.

Cost Impact: Will not increase the cost of construction
This is a clarification of intent, therefore there will be no change in construction requirements.

Committee Action: Disapproved

Committee Reason: The committee believes that the code should not be regulating construction loads as was proposed. Furthermore, the committee is supportive of removing other similar requirements from the IEBC.

Assembly Action: None
Public Comment 1:

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

403.3.2 Construction loads during reroofing: Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

[BS] 706.2 Structural and construction loads: Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

Commenter's Reason: This comment was requested by the IBC/IEBC Structural Committee. EB19 seeks only to reconcile a difference between the IEBC's Prescriptive and Work Area methods. Currently, the Work Area method has a short provision (706.2) about construction loads during reroofing, but the Prescriptive method does not. EB19 originally proposed to add a matching provision to the Prescriptive method as 403.2. We also acknowledged a different approach -- we could just remove section 706.2, because Chapter 15 already covers construction loads.

The committee took our suggestion. Their reason statement reads "[T]he committee is supportive of removing other similar requirements [i.e. 706.2] from the IEBC."

So that is what this public comment does. It deletes the existing section 706.2, and it skips the originally proposed section 403.2.
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Delete and substitute as follows:

[BS] 403.4.1 403.5 Seismic Design Category F Mitigation

Priorities. Where the portion of the building undergoing the intended alteration exceeds 50 percent of the aggregate area of the building, and where the building is assigned to Seismic Design Category F, the structure of the altered building shall be shown to meet the earthquake design provisions of the International Building Code. For purposes of this section, the earthquake loads need not be taken greater than 75 percent of those prescribed in Section 1613 of the International Building Code for new buildings of similar occupancy, purpose and location. New structural members and connections required by this section shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

Where the work area exceeds 50 percent of the building area, and where the building is of any type listed in Table 403.5, the structure of the altered building shall meet the requirements of Sections 1609 and 1613 of the International Building Code. Reduced International Building Code-level seismic forces shall be permitted.

<table>
<thead>
<tr>
<th>Priority Type</th>
<th>Occupancy Risk Category</th>
<th>Seismic Design Category</th>
<th>Size</th>
<th>Location</th>
<th>Structural Attribute</th>
<th>Age</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDC F</td>
<td>-</td>
<td>IV</td>
<td>F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

[BS] 907.4.3 907.5 Seismic Design Category F Mitigation

Priorities. Where the building is assigned to Seismic Design Category F, the evaluation and analysis shall demonstrate that the lateral load-resisting
system of the altered building or structure complies with reduced *International Building Code* level seismic forces in accordance with Section 301.1.4.2 and with the wind provisions applicable to a limited structural alteration.

Where the building is of any type listed in Table 907.5, the structure of the altered building shall meet the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced *International Building Code*-level seismic forces shall be permitted.

**TABLE 907.5**

Mitigation Priorities for Level 3 Alterations

<table>
<thead>
<tr>
<th>Priority Type</th>
<th>Occupancy</th>
<th>Risk Category</th>
<th>Seismic Design Category</th>
<th>Size</th>
<th>Location</th>
<th>Structural Attribute</th>
<th>Age</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDC F</td>
<td>-</td>
<td>IV F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Reason:** This proposal offers an alternate presentation for the current wind and seismic upgrade trigger for essential facilities in high seismic areas (SDC F).

There is no change in intent, substance, or effect relative to the current provisions (see * below).

So if it's just editorial, why do it? To clarify the larger intent of these two code sections: That for certain buildings -- which might vary by jurisdiction -- a Level 3 alteration should come with a lateral system evaluation or retrofit. The current provisions do this for essential facilities in high seismic areas (SDC F buildings). But as demonstrated and proposed in a recent report by the Earthquake Engineering Research Institute (see Bibliography), building owners, code officials, and emergency planners expect the code to do more. When the life of a building is substantially extended through a major architectural renovation or mechanical upgrade, all at significant expense, owners, tenants, and the public expect that the building department will have reviewed the building's safety for earthquakes and hurricanes too. Some large jurisdictions do have such triggers for "major alterations," but they are mostly holdovers from local amendments developed before the old "25-50 rule" was removed in the late 1970s. Other jurisdictions large and small would like to do the same, but with limited resources and amendment-free adoption policies in place, their task is difficult.
The new format proposed here will help them. A single table is provided, and it is easily revised by adding one or more rows. There is no need to write new (and possibly flawed) code language, to figure out where it goes in the code, to write corresponding technical criteria and administrative regs, to match the local priority to some precedent already in the code, etc. All the benefits of the I-codes come with the proposed table.

The table format allows a jurisdiction to identify the buildings of greatest interest to local mitigation and resilience plans. We find that in some jurisdictions the concern is about a particularly vulnerable structure type (like URM, or non-ductile concrete), in some it is about school safety and recovery, in some it is about protecting senior or low-income housing, for some it is about revitalizing a commercial district. A uniform, one-size-fits-all approach no longer suits the needs of communities thinking about natural disaster recovery and resilience. Building code triggers are part of the emergency manager's toolkit. To the extent that a jurisdiction finds them useful or necessary, this proposal will help them.

The alternative, given the growing interest in resilience and disaster recovery planning, might be to extend the "major alteration" trigger for SDC F down to all buildings in SDC E or even D. We believe that is too broad a brush, and the targeted approach suggested by this proposal would be better.

But even if a jurisdiction does nothing to customize these provisions, there is no harm in approving the proposed format. It changes nothing substantive, but it actually clarifies the current code.

* Two versions are provided to ensure consistency between the Prescriptive and Work Area methods. There is no change in intent, substance, or effect relative to the current Work Area provision. Since the current Prescriptive provision does not include a wind requirement, the inclusion of that requirement here for consistency does represent a change of scope. But reconciliation of the methods is being addressed more directly by a separate proposal; here, the focus is on the presentation and structure of the provision, not the wind trigger. If this proposal is approved for its purposes, and that separate reconciliation proposal is disapproved, we will modify this proposal to ensure consistency with the current code with no substantive effect.
Committee Action: Disapproved

Committee Reason: The committee felt that the proposed presentation of wind and seismic triggers may be intriguing, but what's needed for the jurisdiction that is tying to adopt this is more of a roadmap of how to get there. Perhaps in a public comment more information can be provided in the reason that can then go into the commentary, giving examples of the structural attributes and what are the important factors to consider.

Assembly Action: None

Individual Consideration Agenda

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Submitted.
Commenter's Reason: The IBC Structural committee was very complimentary of EB25 and only disapproved it because the proposal doesn't go far enough in telling jurisdictions how they should locally amend the model code -- but that's for YOU to do, as needed for your city, county, or state. In effect, the committee liked this proposal but disapproved it because as the proponent, we didn't overstep our bounds! As a result, you won't get to benefit from what the committee recognized as a clarifying, simplifying, innovative, and useful proposal -- unless you reverse their disapproval. To be clear, EB25 does not make any substantive change to the code. Nor does it require any jurisdiction to add mitigation triggers or add rows to the proposed table. All it does it reformat the existing provision to clarify the code's current mitigation priorities and to help jurisdictions take advantage of a clearer provision -- AS EACH JURISDICTION SEES FIT.

The committee's reason statement asks for a "roadmap," and "commentary," and "examples." First, no such frills are needed for EB25 to work effectively. If approved, the proposed tables will be in the code, already complete. The jurisdiction does not have to do anything to implement or use them. No roadmap or commentary or examples are needed.

But beyond that, the original EB25 reason statement actually DOES have precisely such examples: Unreinforced masonry buildings, non-ductile concrete buildings, school safety and recovery, senior housing, low income housing, and revitalization of commercial districts. Are those not enough? Examples of specific mitigation priorities can be easily found by googling. Seattle, San Francisco, Los Angeles, Massachusetts, and Salt Lake City all offer useful examples, but it would have been wrong for EB25 to focus on those, because EB25 intends to respect local priorities and local policy-making.

As for commentary, we are happy to help ICC write commentary, but no code change proposal should ever be approved or disapproved because of what might go in some commentary that is not even on the agenda. When did an ICC code change hearing ever debate a commentary?

As for a roadmap to resilience-based mitigation programs, again, that would have been way beyond the scope of the proposal. The lack of such an over-reaching roadmap is an invalid basis for disapproving an otherwise helpful proposal.
In brief, the committee turned down a free car because it didn't come with driving lessons. They declined free playoff tickets because they didn't come with a "roadmap" to the stadium. They rejected a very good proposal because it was not perfect in the eyes of a few members -- and in doing so, they assumed that you wouldn't want that very good proposal either.
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Delete without substitution:

406.1 Replacement glass. The installation or replacement of glass shall be as required for new installations.

Revise as follows:

602.3 302.4.1 Glazing in hazardous locations. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the International Building Code or International Residential Code as applicable.

• Exception: Glass block walls, louvered windows, and jalousies repaired with like materials.

Reason: This proposal resolves a discrepancy between the Work Area and Prescriptive methods and builds on the reorganization of Chapter 3 from the last cycle and from Group A. Section 406.1 is about allowable materials, does not contain a trigger, and is independent of project type. Thus, it is out of place in Section 406 and should be in Section 302 instead.

But 406.1 also conflicts with 602.3, which is a more nuanced provision consistent with the philosophy of the IEBC regarding existing materials. The broad requirement in 406.1 that all replacement glass must be as new is problematic; ASCE 7 requires annealed or tempered glass in many cases, and that sometimes brings a requirement for drift capable frames that won't work with existing conditions. Thus, 406.1 should be superseded by 602.3.

But 602.3 appears only in the Repairs chapter of the Work Area method. It has just as much relevance to Alterations. Therefore, 602.3 should be moved to Section 302 as proposed.

Thus, this proposal does two things:

• It moves 602.3 to Section 302, where it will have its proper applicability to all methods and and all project types.
It eliminates 406.1, replacing it with the relocated 602.3.

**Cost Impact:** Will not increase the cost of construction
More limited provision could REDUCE costs.

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**Public Hearing Results**

**Committee Action:** Disapproved

**Committee Reason:** There is a difference between provisions for replacement glass and glazing in hazardous locations. The committee supports the intent of this proposal and encourages a public comment.

**Assembly Action:** None

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**Individual Consideration Agenda**

**Public Comment 1:**

**Proponent:** David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Modified by this Public Comment.

**Replace Proposal as Follows:**

**2015 International Existing Building Code**

**602.3 302.4.1 Glazing in hazardous locations.** Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the *International Building Code* or *International Residential Code* as applicable.

**Exception:** Glass block walls, louvered windows, and jalousies repaired with like materials.

**Commenter's Reason:** This public comment was requested by the IBC Structural committee, as stated in its reason statement.
EB35 proposed two small changes to reconcile differences between the Prescriptive and Work Area methods regarding glazing falling hazards. This comment keeps one of those changes (moving current section 602.3 to Chapter 3) and withdraws the other one (deleting section 406.1).

The reason for the change to 602.3 is the same: By moving this brief provision to Chapter 3, we ensure that it applies, appropriately, to both the Prescriptive and Work Area methods and to alteration projects as well as repairs.

Section 406.1, however, is part of a larger section about glass replacement in general. As pointed out at the hearings, section 406 should remain intact. Reconciliation of the two methods requires more than simply deleting section 406.1. As the proponent of EB35, we accept that and are submitting this comment to modify EB35 accordingly. In correspondence, our colleague Eric Stafford (who opposed EB35 on behalf of IBHS) has indicated his support for EB35 as modified by this public comment.

EB35-16
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

[BS] 407.4 Structural. When a change of occupancy results in a structure being reclassified to a higher risk category, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the structure shall conform to the seismic requirements for a new structure of the higher risk category. For purposes of this section, compliance with ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table 301.1.4.1 for the applicable risk category, shall be deemed to meet the requirements of Section 1613 of the International Building Code.

Exceptions:

1. Specific seismic detailing requirements of Section 1613 of the International Building Code for a new structure shall not be required to be met where the seismic performance is shown to be equivalent to that of a new structure. A demonstration of equivalence shall consider the regularity, overstrength, redundancy and ductility of the structure.

2. When a change of use results in a structure being reclassified from Risk Category I or II to Risk Category III and the structure is located where the seismic coefficient, SDS, is less than 0.33, compliance with the seismic requirements of Section 1613 of the International Building Code is not required.

3. Where the change is from a Group S or Group U occupancy, reduced International Building Code-level seismic forces shall be permitted.

[BS] 1007.3.1 Compliance with International Building Code-level seismic forces. Where a building or portion thereof is subject to a change of occupancy that results in the building being assigned to a higher risk category based on Table 1604.5 of the International Building Code, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the building shall comply with the requirements for
International Building Code-level seismic forces as specified in Section 301.1.4.1 for the new risk category.

Exceptions:

1. 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 equivalent level of performance and seismic safety is obtained for the applicable risk category based on the provision for reduced International Building Code-level seismic forces as specified in Section 301.1.4.2.

2. 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, the occupant load of the area with the new occupancy is not increased, and the new occupancy is not classified as Risk Category IV. For the purposes of this exception, buildings occupied by two or more occupancies not included in the same risk category, 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.

3. Unreinforced masonry bearing wall buildings in Risk 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)].

4. Where the change is from a Group S or Group U occupancy, reduced International Building Code-level seismic forces shall be permitted.

Reason: This proposal re-introduces a common sense seismic upgrade trigger of the type the code had until 2012, but with the allowance of reduced loads.

For the 2012 code, the seismic upgrade triggers for change of occupancy projects were greatly simplified so that an upgrade is triggered only when the change is so significant that it bumps the building into a higher risk category. This was a useful improvement to the previous set of triggers, but it was a bit of an over-reach in one regard. Quite often, the ground floor of a residential building is converted from a storage, parking, or utility area, often unfinished,
to an occupied residential unit or leasable office or commercial space. In a seismically deficient building, such a change represents a significant increase in risk that the code should not ignore.

In the 2009 IEBC (Work Area method), such a change of occupancy would have triggered a full-building seismic upgrade with full code-level loads. Since 2012, however, since such a change would not affect the risk category (it would be II before and after), no evaluation or upgrade is triggered for these cases. (The alteration normally associated with such a change of occupancy also would not trigger any seismic work.) San Francisco, which is trying to encourage both seismic retrofit and the conversion of accessory dwelling units, has recognized this problem and is implementing a similar solution. This proposal would re-introduce the seismic upgrade trigger for these specific cases. Notes:

- Matching provisions are proposed for the Prescriptive and Work Area methods.
- The 10% "small area" exception is modified to prevent gaming, since the cases in question often involve only part of the first story.
- An exception to the full-code criteria is added. Since these occupancy changes are less significant than a wholesale shift in risk category, we suggest that the use of reduced seismic loads is appropriate. For many woodframe apartment buildings, the use of reduced loads also allows IEBC Appendix A4, which would effectively limit any retrofit work to the first story, making the triggered retrofit quite feasible.

**Cost Impact:** Will increase the cost of construction
The cost of converting an unfinished space to a functional residential unit would be increased by the cost of a retrofit with reduced forces.

Public Hearing Results

Committee Action: Disapproved
Committee Reason: While agreeing with the reasoning of the proposal to address change of occupancies involving Groups S and U, there hasn't been sufficient justification presented to require this when the Group S or Group U is on the side or top of the building. Also requirements to address soft stories typically would address only that part of the structure, but this proposal appears to trigger more than that.

Assembly Action: None

Individual Consideration Agenda

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Submitted.

Commenter's Reason: As stated in its reason, the IBC Structural committee AGREES with the overall reasoning of EB39, which says that if an occupancy is changed from unoccupied storage or utility to an occupied space -- residential, business, etc. -- such a change justifies a review of the building's seismic risk. Yes, it does. Yet the committee disapproved the proposal because of a misplaced concern over rare conditions and a misunderstanding of why current retrofit programs are scoped the way they are. The committee's reason seems to suggest that if you add risk by increasing the occupant load at the bottom of the building, that's a concern, but if you add risk by doing the same thing in the second story, that's ok. Four reasons why this objection is flawed:

1. The issue here is seismic safety, and most seismic collapses threaten the whole building, not just the first story. Indeed, converting an unoccupied space to occupied is conceptually more like adding new units than merely changing the use, regardless of what part of the building they're in; this is just the sort of risk increase that should justify a seismic review -- which the committee otherwise acknowledged. Certainly we make no such exception for the "side or top" of a building when the other triggers in Sections 407.4 and 1007.3.1 apply due to an increase in risk category.
2. Regarding a change of occupancy on the "side" of the building, if that "side" is structurally independent then the rest of the building would not be affected anyway, and if it is not independent, then the performance of the rest of the building is absolutely relevant.

3. Nearly all of the cases where this change of occupancy trigger would apply ARE at the bottom of the building, so by disapproving EB39 the committee is overlooking a quite common condition by overstating the case of a rare one.

4. The proposal would not make an entirely new requirement. It merely restores a requirement that was already in the code in 2009 but was removed by an over-reaching simplification to Chapter 10 in 2012. So there is precedent for what EB39 proposes.

The second part of the committee's reason mentions typical "soft story" retrofit programs that only require retrofit of the critical story (generally only the first story). Unfortunately, this is not a valid objection to the proposal, for two reasons:

2. In some cases, even if the proposed trigger applies, by allowing the use of reduced seismic loads, EB39 would also allow the use of Appendix A3 or A4, which only require retrofit in the critical lower stories -- just as the committee seems to prefer.

3. The mitigation programs cited by the committee are typically MANDATORY programs that apply even if there is no change of occupancy at all. In those cases, where there is no risk increase from a change of occupancy, it does make sense to limit the mandated work to the critical first story. That is different from a voluntary change of occupancy that ADDS RISK. Where the risk is increased -- either from a critical change in use or, in this case, by the creation of new occupied spaces -- a full building review is standard.

EB39-16
IEBC: 408.4 (New), [BS] 1206.1.

Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Add new text as follows:

408.4 Structural. Historic buildings shall comply with the applicable structural provisions in this Chapter.

Exception: The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.

Revise as follows:

[BS] 1206.1 General. Historic buildings shall comply with the applicable structural provisions for the work as classified in Chapter 5.

Exception: The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any such floor.

Reason: This proposal reconciles a significant difference between the Prescriptive and Work Area methods.

In the current Prescriptive method, Section 408.1 says that improvements to the existing building need be made only if they are specifically required. The balance of Section 408 has no specific structural checks or upgrade triggers - - not even for added dead load or removal of a structural element -- so depending on interpretation, 408.1 has the effect of saying that historic buildings are exempt from any structural work.

By contrast, in the current Work Area method, Section 1206.1 says specifically that the code's common sense structural provisions do apply to historic buildings.

This proposal would match the Prescriptive method to the Work Area method, clarifying that the Chapter 4 structural requirements are safety-related and therefore should be enforced in historic buildings. The proposed wording of new section 408.4 is borrowed directly from 1206.1.
The proposed revision to Section 1206.1 is merely an editorial clarification. In concept, one could argue that historic structures should be exempt from the code's few wind and seismic upgrade triggers. We might be open to that, but at the very least all checks of dead, live, and snow load, as well as confirmations of adequacy when the de facto structure is altered, should be enforced. And in any case, there is no reason for the Prescriptive and Work Area methods to differ in their structural provisions.

**Cost Impact:** Will increase the cost of construction
If you read current 408.1 to exclude structural work, this proposal could increase construction costs. If you read current 408.2 to mean that safety-related structural provisions already apply, then this proposal will have no effect on costs.

**Public Hearing Results**

**Committee Action:** Approved as Submitted

**Committee Reason:** This proposal provides the direction needed to apply the structural provisions of this chapter and gives the building official the authority to evaluate the historical building and make exceptions where needed.

**Assembly Action:** None

**Individual Consideration Agenda**

**Public Comment 1:**

**Proponent:** David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Modified by this Public Comment.

**Modify as Follows:**
408.4 Structural. Historic buildings shall comply with the applicable structural provisions in this Chapter.

**Exception Exceptions:**

1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. Repair of substantial structural damage is not required to comply with Sections 404.2 and 404.3. Substantial structural damage shall be repaired in accordance with Section 404.4.

[BS] 1206.1 General. Historic buildings shall comply with the applicable structural provisions for the work as classified in Chapter 5.

**Exception: Exceptions:**

1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. Repair of substantial structural damage is not required to comply with Sections 606.2.2 and 606.2.3. Substantial structural damage shall be repaired in accordance with Section 606.2.1.

**Commenter's Reason:** As noted in the EB41 reason statement, the proposal as submitted addresses a significant discrepancy between the code's two methods for historic buildings. Currently, the Work Area method (1206.1) subjects historic buildings to the same structural upgrade triggers as non-historic buildings, but the Prescriptive method (408) does not. EB41 resolves the discrepancy by adding a provision to the Prescriptive method (approved 408.4) to match the Work Area method. Thus, as submitted and approved, historic buildings will be subject to the same structural upgrade triggers as non-historic buildings, with either method. This represents no change to the Work Area method, but a potentially significant change to the Prescriptive method.
This proposed modification offers something of a compromise for both methods. A rational argument can be made that historic buildings should not be subject to expensive and disruptive wind and seismic retrofits when those retrofits are triggered by repairs. Alterations, additions, relocations, and changes of occupancy are all voluntary; those projects should be subject to sensible upgrade triggers, even for historic buildings, and the projects can be scoped and budgeted to accommodate these requirements with due regard for historic preservation. EB41, as submitted and approved, does this. Repairs, however, are not voluntary, so an upgrade triggered by repair might be at odds with the priorities of preservation. Not everyone will agree with this approach; after all, historic buildings are expected to provide adequate safety too, as contemplated by current (though vague) 408.2. But if historic buildings should ever be exempt from the code's sensible wind and seismic retrofit triggers, it should be in the case of involuntary repairs.

Public Comment 2:

Proponent: Gwenyth Searer, representing self requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

408.4 Structural. Historic buildings shall comply with the applicable structural provisions in this Chapter.

Exceptions:

Exception:

1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.

2. Repairs are not required to comply with the substantial structural damage retrofit requirements of Sections 404.2 and 404.3.

[BS] 1206.1 General. Historic buildings shall comply with the applicable structural provisions for the work as classified in Chapter 5.

Exception Exceptions
1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.

2. Repairs are not required to exceed the requirements of Section 1202.

Commenter's Reason: The changes approved in EB41-16 conflict with the requirements for repairs of historic buildings in other portions of the IEBC and are likely to result in confusion. The changes in EB 41-16 also conflict with the change approved in EB54-16.

This proposed modification brings the various requirements for repair of historic buildings into alignment throughout the IEBC.

- According to Section 1202.1, repairs are permitted with original or like materials and original methods of construction.
- According to Section 1202.4, replacement of existing or missing features using original materials is permitted.
- According to Section 601.1, repairs need only comply with Chapter 12; this wording effectively bypasses all of the upgrade triggers in Chapter 6.
- And EB54-16, which was approved by the ICC-Structural Committee As Submitted, struck the requirement for a report from Section 1201.2 for repairs to historic buildings because a report is not needed to repair a historic structure (again, because repairs in like-kind and using original methods of construction are permitted).

This public comment does not affect how alterations of and additions to historic buildings are dealt with. This public comment also does not affect the ability of code officials to require mitigation of dangerous or unsafe conditions (Sections 401.3 and 1202.2, respectively).

The portions of the IEBC that deal with historic buildings were modeled after the California Historical Building Code (CHBC). This public comment brings EB41-16 into alignment with the originally intended treatment of historic buildings with respect to repair -- i.e., put it back the way it was unless that condition is dangerous or unsafe.
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

[BS] 907.1 General. Where buildings are undergoing Level 3 alterations including structural alterations, the provisions of this section shall apply.

Reason: This proposal clarifies the intended application of section 907. As written, 907 applies to "Level 3 alterations including structural alterations." This wording is unclear:

- Does it mean that 907 applies only to Level 3 alterations that happen to include major structural work?
- Or does it mean that all "structural alterations" should always be considered Level 3 Alterations to which 907 generally applies?

Certainly the second choice is incorrect, as that meaning would improperly redefine what it means to be a Level 3 Alteration. It would be wrong to say that moving one post or cutting one hole should be deemed Level 3.

But even the first choice fails to reflect most users' expectation that 907 applies to any Level 3 project whether or not the intended work involves any structural alteration. Certainly this was the understanding when the proactive provisions in 907.4.3, 907.4.5, and 907.4.6 were added. Those provisions recognize that when a building gets essentially a new life through an extensive renovation, some basic structural mitigation should be triggered. It makes no sense, and it destroys the intent of these sensible provisions, to say that they can be avoided by restricting the scope of your major alteration project to architectural, accessibility, mechanical, electrical, cladding, and energy conservation improvements.

This proposal deletes the three problematic words, eliminating confusion and confirming the applicability of 907.4.3, 907.4.5, and 907.4.6.
Are there any implications to the rest of 907, specifically to 907.4.2 and 907.4.4, which address the structural systems as a whole? Answer: No. With respect to these provisions, the question of whether 907 applies to alterations with or without structural scope is moot. Consider:

- Assume 907 is meant to apply only to Level 3 Alterations with structural scope. Then a project with structural scope would trigger upgrade by 907.4.2 if the scope was SSA, and would not trigger upgrade otherwise. The lesser structural scope would still have to comply with Chapter 8 (per 907.4.4).
- Now assume that 907 is meant to apply as proposed, to all Level 3 Alterations, with or without structural scope. If there is structural scope, then the result is the same as in the previous assumption. If there is no structural scope, then you get the same result (i.e. comply with Chapter 8) as in the previous assumption with less than SSA.

The same result means the question is moot, so the proposal has no effect on the SSA trigger at the heart of Section 907.

Now, with this proposal, 907.1 would read, "Where buildings are undergoing Level 3 alterations, the provisions of this section shall apply." This is harmless, but one might also argue that it is unnecessary, since Section 907, by being in Chapter 9, already applies to any Level 3 Alteration by definition. So we are open to a modification that simply deletes Section 907.1 in its entirety.

**Cost Impact:** Will not increase the cost of construction
This is a clarification of current intent so there is no change to construction requirements.
Committee Reason: This code change clarifies the IEBC by removing confusing verbiage, because it is agreed that level 3 alterations should require compliance with Section 907.

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Existing Building Code

[BS]-907.1 General: Where buildings are undergoing Level 3 alterations, the provisions of this section shall apply.

Commenter's Reason: This comment does a little housekeeping on EB48 as already approved.

As noted at the end of the original EB48 reason statement, if the proposal is approved as submitted -- and it has been -- then the clarified text that remains will actually be completely redundant. That is, it can be removed with no loss of substance at all.

So that is what this PC does.
Proposed Change as Submitted

Proponent: Edward Kulik, representing Building Code Action Committee (bcac@icc.org)

2015 International Existing Building Code

[BS] 1201.2 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 code, 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. For buildings assigned to Seismic Design Category D, E or F, a structural evaluation describing, at a minimum, the vertical and horizontal elements of the lateral force-resisting system and any strengths or weaknesses therein shall be prepared. Additionally, 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.

[BS] 1206.1 General. Historic buildings shall comply with the applicable structural provisions for the work as classified in Chapter 5.

Exceptions:

1. The code official shall be authorized to accept existing floors and approve operational controls that limit the live load on any such floor.

2. Where compliance with the intent of this code is accomplished and documented in accordance with Section 1201.2

Reason: There is a very weak link in Chapter 12 between the report that is required in Section 1201.2 and flexibility given to the structural aspect of historic buildings. Currently Section 1206.1 gives the impression that full compliance with the work area method is required regardless of any report in Section 1201.2 being developed.
This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2014 and 2015 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: BCAC (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

**Cost Impact:** Will not increase the cost of construction
This proposal is a clarification of the requirements and may reduce costs by providing for proper application.

**Public Hearing Results**

**Committee Action:** Disapproved

**Committee Reason:** The committee felt the new exception is not needed in Section 1206.1. The change substituting "code" for "chapter" is appropriate, however, and the committee recommends addressing this through a public comment.

**Assembly Action:** None

**Individual Consideration Agenda**

**Public Comment 1:**

**Proponent :** Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org) requests Approve as Modified by this Public Comment.
Modify as Follows:

2015 International Existing Building Code

[BS] 1206.1 General. Historic buildings shall comply with the applicable structural provisions for the work as classified in Chapter 5.

Exceptions:

1. The code official shall be authorized to accept existing floors and approve operational controls that limit the live load on any such floor.
2. Where compliance with the intent of this code is accomplished and documented in accordance with Section Sections 1201.2, 1202 and 1205.

Commenter's Reason: The committee felt that the change proposed to Section 1206.1 was appropriate, but the proposed exception #2 needed to also make a cross reference to Section 1202 and 1205 to correlate with previous actions regarding minimum repair or change of occupancy requirements. The BCAC agrees that this is an appropriate reference; therefore, this public comment includes that cross reference.

This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Between 2014 and 2016 the BCAC has held 8 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed public comments. Related documentation and reports are posted on the BCAC website at: BCAC (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

EB55-16
Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

[BS] 1302.3 Wind loads. Buildings shall comply with wind provisions for new construction at the new location using the International Building Code or International Residential Code wind provisions as applicable.

- **Exceptions Exception:**
  - 1. Detached one- and two-family dwellings and Group U occupancies where wind loads for new construction at the new location are not higher than those at the previous location.
  - 2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1302.4 Seismic loads. Buildings shall comply with seismic provisions for new construction at the new location using the International Building Code or International Residential Code seismic provisions at the new location as applicable.

- **Exceptions Exception:**
  - 1. Structures assigned to Seismic Design Category A or B and detached one- and two-family dwellings assigned to Seismic Design Category A, B, or C where the seismic loads for new construction at the new location are not higher than those at the previous location.
  - 2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1302.5 Snow loads. Structures shall comply with International Building Code or International Residential Code snow loads as applicable where snow loads provisions for new construction at the new location are higher than those at using the previous location: International Building Code or International Residential Code, as applicable.

- **Exception:** Structural elements whose stress is not increased by more than 5 percent.
Exception: Structures for which the snow loads for new construction at the new location are not higher than those at the previous location.

Reason: This proposal clarifies the structural upgrade exceptions for relocated buildings and restores some of the intent of the Prescriptive provision (Section 409.1) that was simply eliminated without Structural Committee input in Group A.

For wind, seismic, and snow loads, current Section 1302 generally requires relocated buildings to meet requirements for similar new buildings. It provides two types of exceptions:

1. Exceptions where the loads in the new location are no higher than in the old location, for specific buildings and occupancies.
2. A "10% rule" for wind and seismic, and a "5% rule" for snow.

This proposal retains the first set of exceptions (with editorial revisions) and removes the second set of exceptions because they are unclear in intent and application. For example, what does it mean to have a "stress increase" due to seismic loads associated with a relocation? Does the exception intend to compare current loads at the new location with current loads at the old location? If so, that is what Exception 1 already does, without the need for percentages. Or does it intend to compare the original design loads at the old location with current design loads at the new location, as if the relocated structure were a new building to be compared with the old one? That would be inconsistent with any other IEBC provision. In short, the "10% rule" exception for relocated buildings is unclear and unnecessary.

More important, while a "10% rule" is appropriate for an addition or a typical alteration as a way of keeping upgrade costs proportional to intended project costs, such a rule should not apply to the wholesale relocation of a building. A relocation should be considered on par with a Level 3 alteration with substantial structural scope, for which the IEBC does require wind and seismic upgrade. That is why the Prescriptive provision in Section 409 (prior to its removal in Group A) simply said that a relocated building should be treated like a new structure, without exceptions.

The proposal also makes editorial clarifications for consistent wording and structure. Thus, the "no higher" snow load provision is moved to an exception to match the structure used for wind and seismic.
**Cost Impact:** Will increase the cost of construction
Might increase the cost of relocation for some buildings, depending on whether loads in the new location are higher, and on how the unclear 10% exceptions were interpreted. For users of the Prescriptive method, the proposal represents a reduction in cost.

**EB56-16 : [BS]
1302.3-
BONOWITZ12825**

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**Public Hearing Results**

**Committee Action:** Disapproved

**Committee Reason:** The committee disagrees with the removal of what are considered common sense triggers. Doing so would require an upgrade just because a building is moved. There is no problem in determining demand-capcity ratios and in calculating the effect of the relocation on the structure. When moving a structure sometimes it is only necessary to check the bottom of the structure.

**Assembly Action:** None

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**Individual Consideration Agenda**

**Proponent:** David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Submitted.

**Commenter's Reason:** The committee's reason for disapproval of EB56 shows that they did not understand the intent of the proposal and were misled by mistaken statements made during committee deliberations, after testimony was closed. Consider each part of the committee's reason statement:

- "The committee disagrees with the removal of what are considered common sense triggers." EB56 does not remove any triggers at all. To be fair, this is probably an honest mistake by ICC staff; it probably means to say "common sense exceptions."
- Approval "would require an upgrade just because a building is moved."
First, that is exactly what the IEBC's prescriptive method CURRENTLY requires, so it is hardly a radical idea without precedent. Second, this is not even true; a cursory look at the proposal shows that EB56 retains 3 of the 4 current exceptions. Third, allowing a relocation with the current "10% rule" exceptions effectively removes any review of structural safety when a deficient building is moved from one jurisdiction to a neighboring one. With these exceptions, a building that you would never allow to be built new in your jurisdiction can instead be trucked in with no restrictions, unless somehow the wind, seismicity, or snow in your town is a lot higher than in the next town over. This is too low a bar.

- "There is no problem in determining demand-capacity ratios [or] the effect of the relocation." Agreed, but this misses the point. Of course a change in DCR can be calculated, but it is very likely to be zero, even for a highly deficient and unsafe structure. As the EB56 reason statement explains, exceptions based on the percentage of DCR change make sense when the intended work would change the building itself, as for an addition or alteration. But the logic is not the same for a relocation.
- "When moving a structure sometimes it is only necessary to check the bottom of the structure." Ok, but that is obviously not the case when the rest of the structure -- the roof or the lateral system -- is plainly deficient. In those cases, the current exceptions are preventing common sense safety checks and allowing deficiencies that would never be tolerated in a new building. These exceptions must be deleted as proposed for section 1302 to have any meaning.

In the end, EB56 simply retains what is already in the 2015 IEBC Prescriptive Method, Section 409: Relocated buildings are to be treated as if they are being erected new. Unfortunately, Section 409 was improperly removed in Group A without a full hearing by the Structural Committee (let alone the ICC membership) regarding reconciliation between the Prescriptive and Work Area methods. EB56 helps correct that oversight.

EB56-16
EB57-16

Proposed Change as Submitted

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net)

2015 International Existing Building Code

Revise as follows:

[BS] 1302.3 Wind loads. Buildings shall comply with wind provisions for new construction at the new location using the International Building Code or International Residential Code, as applicable.

Exceptions:

0.1. Detached one- and two-family dwellings and Group U occupancies where wind loads at the new location are not higher than those at the previous location.

0.2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1302.4 Seismic loads. Buildings shall comply with International Building Code or International Residential Code seismic provisions for new construction at the new location using the International Building Code or International Residential Code, as applicable.

Exceptions:

1. Structures in Seismic Design Categories A and B and detached one- and two-family dwellings in Seismic Design Categories A, B and C where the seismic loads at the new location are not higher than those at the previous location.

2. Structural elements whose stress is not increased by more than 10 percent.

1. Structures assigned to Seismic Design Category A or B, based on the new location.

2. Detached one- and two-family dwellings assigned to Seismic Design Category C, based on the new location.

[BS] 1302.5 Snow loads. Structures shall comply with International Building Code or International Residential Code snow loads as applicable where snow loads provisions for new construction at the new location are higher.
than those at the previous location using International Building Code or International Residential Code, as applicable.

**Exception:** Structural elements whose stress is not increased by more than 5 percent.

**Reason:** This proposal makes editorial clarifications and deletes the highly unconservative exceptions, matching three two Work Area provisions to the Prescriptive provision (409.1) that was removed without Structural Committee input in Group A.

The intent of these exceptions is apparently to avoid the cost of sensible, safety upgrades -- even for the wholesale relocation of an entire building. However, for wind and snow, they do not waive the upgrade for, say, historic buildings where such costs might be destructive, they do not waive the upgrade only for moves within the same lot, which maintain the existing risk, and they do not waive the upgrade based on an low risk, as the exception to 1302.4 does for areas of low seismicity. Any of those approaches might be more reasonable.

Rather, these exceptions effectively say that while it is not acceptable to build a deficient new house in your jurisdiction, it is completely ok to move an even worse one in from the neighboring town or suburb. That makes no sense, and it is no way to manage the risk of an existing building stock. Section 409 did not provide these exceptions, and the Work Area method shouldn't either. (We are open to exceptions based on low risk, as in 1302.4, but such a revision is beyond the scope of this proposal.)

Exceptions to structural safety upgrades make sense for a small addition or alteration; they look for significant risk increases and keep upgrade costs proportional to intended project costs. But such rules should not apply to the wholesale relocation of a building. A relocation should be considered on par with a Level 3 alteration with substantial structural scope, for which the IEBC does require wind and seismic upgrade (see Section 907.4). That is why the Prescriptive provision in Section 409 (prior to its removal in Group A) simply said that a relocated building should be treated like a new structure, without exceptions.

Thus, appropriate exceptions for relocation should exempt low risks, not small changes to already risky buildings. Therefore, this proposal does the following:
- In 1302.3, for wind, remove both exceptions as they inappropriately allow high-risk buildings to be relocated without risk reduction.
- In 1302.5, for snow, remove the exception and part of the provision, as they inappropriately allow high risk buildings to be relocated without risk reduction.
- In 1302.4, for seismic:
  - Maintain the exception for buildings in SDC A or B. These are already low risk regardless of whether the seismicity changes.
  - Maintain the exception for dwellings in SDC C. These are riskier than similar houses in SDC A or B, but the exception seems consistent with other exceptions for IRC-eligible dwellings in other IEBC sections.
  - Remove the part of the exception about "seismic loads ... not higher than those at the previous location" because this is unnecessary once the exception is already limited by SDC.

Regarding 1302.4: The current wording is unclear, and redundant. Once SDC A and B buildings are exempt, there is no need to call out SDC A and B dwellings separately. Also, it is unclear whether the "where the seismic loads ..." phrase applies to both sets of buildings or just the second set. Therefore, the proposal splits the two sets into separate exceptions for clarity, and the troublesome phrase is deleted as unnecessary, as explained above.

**Cost Impact:** Will increase the cost of construction
Cost increases for the upgrades made necessary by eliminating some exceptions. But will decrease the cost of future repair and recovery associated with damage to deficient relocated buildings.
Committee Reason: Disapproval is consistent with the action taken on EB56-16. The proposal would delete reasonable exceptions for relocated buildings. The triggers allowing five and ten percent stress increases for relocated buildings are small, not excessive, allowances that should be kept.

Assembly Motion: As Submitted
Online Vote Results: Failed
Support: 48.77% (119) Oppose: 51.23% (125)
Assembly Action: None

Individual Consideration Agenda

Proponent: David Bonowitz, representing National Council of Structural Engineers Associations (dbonowitz@att.net) requests Approve as Submitted.

Commenter's Reason:
The committee's reason for disapproval of EB57 relies on its mistaken disapproval of EB56. If the decision on EB56 can be reversed, then we should also reconsider EB57.

EB56 deals with the faulty logic of using a "percent change" exception for relocation projects, which are conceptually different from alteration or addition projects. Maintaining such exceptions would allow highly deficient buildings to be moved into your jurisdiction with essentially no checks of structural adequacy or safety.

EB57 looks at what's left after EB56 and recognizes that even the remaining exceptions do not make sense for relocation projects, as explained in the original proposal's reason statement.
Proposed Change as Submitted

Proponent: James Lai, David Ojala, S.E., Chair, SEAOC Existing Building Committee; Fred Turner, S.E., Chair Ad Hoc committee; James S. Lai, S.E., Member, Ad Hoc Committee, representing Structural Engineers Association of California (dojala@exponent.com)

2015 International Existing Building Code
APPENDIX A Guidelines for the Seismic Retrofit of Existing Buildings
CHAPTER PART A1—SEISMIC STRENGTHENING PROVISION FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS
Revise as follows:

[BS] A102.1 General. The provisions of this chapter shall apply to all existing buildings not more than six stories in height above the base of the structure and having at least one unreinforced masonry bearing wall. The elements regulated by this chapter shall be determined in accordance with Table A1-A. Except as provided herein, other structural provisions of the building code shall apply. This chapter does not apply to the alteration of existing electrical, plumbing, mechanical or fire safety systems.

Add new definition as follows:

BED JOINT. The horizontal layer of mortar on which a masonry unit is laid.

Revise as follows:

[BS] CROSSWALL.
A new or existing wall that meets the requirements of Section A111.3 and the definition of Section A111.3. A crosswall is not a shear wall.

Add new definition as follows:

DETAILED BUILDING SYSTEM ELEMENTS.
The localized elements and the inter-connections of these elements that define the design of the building.

Revise as follows:

[BS] FLEXIBLE DIAPHRAGM.
A diaphragm of wood or untopped metal deck construction in which the horizontal deformation along its length is at least two times the average story drift.

Add new definition as follows:

HEAD JOINT.
The vertical mortar joint placed between masonry units within the wythe.

Revise as follows:

[BS] OPEN FRONT.
An exterior building wall line on one side only without vertical elements of the lateral seismic force-resisting system in one or more stories.

[BS] RIGID DIAPHRAGM.
A diaphragm of concrete construction or concrete filled metal deck construction.

[BS] UNREINFORCED MASONRY (URM).
Includes burned clay, concrete or sand-lime brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

[BS] UNREINFORCED MASONRY (URM) WALL.
A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than 25 percent of the minimum ratio required by the building code amounts as defined for reinforced masonry walls.

[BS] UNREINFORCED MASONRY BEARING WALL.
A URM wall that provides the vertical support for the reaction of floor or roof-framing members for which the total superimposed vertical load exceeds 100 lbs. per linear foot of wall length.

SECTION A104 SYMBOLS AND NOTATIONS
For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.
\( a_n \) = Diameter of core multiplied by its length or the area of the side of a square prism.

\( A \) = Cross-sectional area of unreinforced masonry pier or wall, square inches \((10^{-6} \text{ m}^2)\).

\( A_b \) = Total area of the bed joints above and below the test specimen for each in-place shear test, square inches \((10^{-6} \text{ m}^2)\).

\( A_{nt} \) = Area of net mortared or grouted section of a wall or wall pier.

\( D \) = In-plane width dimension of pier, inches \((10^{-3} \text{ m})\), or depth of diaphragm, feet \((\text{m})\).

\( DCR \) = Demand-capacity ratio specified in Section A111.4.2.

\( f_{m}'' \) = Compressive Lower bound masonry compressive strength of masonry.

\( f_{sp} \) = Tensile-splitting strength of masonry.

\( F_{wx} \) = Force applied to a wall at level x, pounds \((\text{N})\).

\( H \) = Least clear height of opening on either side of a pier, inches \((10^{-3} \text{ m})\).

\( h/t \) = Height-to-thickness ratio of URM wall. Height, \( h \), is measured between wall anchorage levels and/or slab-on-grade

\( L \) = Span of diaphragm between shear walls, or span between shear wall and open front, feet \((\text{m})\).

\( L_c \) = Length of crosswall, feet \((\text{m})\).

\( L_i \) = Effective diaphragm span for an open-front building specified in Section A111.8, feet \((\text{m})\).

\( P \) = Applied force as determined by standard test method of ASTM C 496 or ASTM E 519, pounds \((\text{N})\).

\( P_{D} \) = Superimposed dead load at the location under consideration, pounds \((\text{kN})\). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.

\( P_{D+L} \) = Press Stress resulting from the dead plus actual live load in place at the time of testing, pounds per square inch \((\text{kPa})\).

\( P_{test} \) = Splitting tensile test load determined by standard test method ASTM C496, pounds \((\text{N})\).

\( P_w \) = Weight of wall, pounds \((\text{N})\).

\( R \) = Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE

\( S_{DS} \) = Design spectral acceleration at short period, in g units.

\( S_{D1} \) = Design spectral acceleration at 1-second short period, in g units.

\( S_{D1} \) = Design spectral acceleration at 1-second period, in g units.

\( v_a \) = The shear strength of any URM pier, \( v_m A/1.5 \) pounds \((\text{N})\).

\( v_c \) = Unit shear capacity value strength for a crosswall sheathed with any of the materials given in Table A1-D or A1-E, pounds per foot \((\text{N/m})\).

\( v_m \) = Shear strength of unreinforced masonry, pounds per square inch \((\text{kPa})\).
The shear strength of any URM pier or wall, pounds (N).

Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, pounds (N).

Total shear capacity of crosswalls in the direction of analysis below the diaphragm level being investigated, pounds (N).

Load at incipient cracking for each in-place shear test performed in accordance with Section A106.3.3.1, pounds (kN).

Mortar (bed joint) shear test values as specified in Section A106.3.3.5, pounds per square inch (kPa).

Load at incipient cracking for each in-place shear test performed in accordance with Section A106.3.3.1, pounds (kN).

Lower bound mortar shear strength, pounds per square inch (kPa).

Mortar shear test values as specified in Section A106.3.3.5, pounds per square inch (kPa).

Unit shear capacity value for a diaphragm sheathed with any of the materials given in Table A1-D or A1-E, pounds per foot (N/m).

Total shear force resisted by a shear wall at the level under consideration, pounds (N).

Total seismic dead load as defined in the building code, pounds (N).

Total dead load tributary to a diaphragm level, pounds (N).

Total dead load of a URM wall above the level under consideration or above an open-front building, pounds (N).

Dead load of a URM wall assigned to level x halfway above and below the level under consideration, pounds (N).

Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).

For diaphragms coupled with crosswalls, includes the sum of shear capacities of both ends of diaphragms coupled at and above the level under consideration, pounds (N).

Total dead load of all the diaphragms at and above the level under consideration, pounds (N).

SECTION A105 GENERAL REQUIREMENTS

[B] A105.1 General. The seismic force-resisting system specified in this chapter shall comply with the building code and referenced standards, except as modified herein.

[B] A105.3 Requirements for plans. The following construction information shall be included in the plans required by this chapter:

1. Dimensioned floor and roof plans showing existing walls and the size and spacing of floor and roof-framing members and sheathing materials. The plans shall indicate all existing and new crosswalls and shear walls, and their materials of construction. The location of these walls and their openings shall be fully dimensioned and drawn to scale on the plans.

2. Dimensioned URM wall elevations showing openings, piers, wall classes as defined in Section A106.3.3.8, thickness, heights, wall shear test locations, cracks or damaged portions requiring repairs, the general condition of the mortar
The type of interior wall and ceiling materials, and framing.

3. The type of interior wall and ceiling materials, and framing.

4. The extent and type of existing wall anchorage to floors and roof when used in the design.

5. The extent and type of parapet corrections that were previously performed, if any.

6. Repair details, if any, of cracked or damaged unreinforced masonry walls required to resist forces specified in this chapter.

7. All other plans, sections and details necessary to delineate required retrofit construction.

8. The design procedure used shall be stated on both the plans and the permit application.

9. Details of the anchor prequalification program required by Section A107.5.3, if used, including location and results of all tests.

10. Construction quality assurance requirements of special inspection for all new construction materials and for retrofit construction including: anchor tests, pointing or repointing of mortar joints, installation of adhesive or mechanical anchors, and other elements as deemed necessary to ensure compliance with this Appendix.

[BS] A105.4 Structural observation, testing and inspection. Structural observation, in accordance with Section 1708 1704.5 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 and existing construction materials shall be in accordance with the building code, except as modified by this chapter.

Special inspection as described in Section A105.3 Item 10 shall be provided equivalent to Level 3 as prescribed in TMS 402 Table 3.1(2), Minimum Special Inspection Requirements.

SECTION A106 MATERIALS REQUIREMENTS

Delete without substitution:

[BS] A106.1 - General. Materials permitted by this chapter, including their appropriate strength design values and those existing configurations of materials specified herein, may be used to meet the requirements of this chapter.

Delete and substitute as follows:

[BS] A106.2 A106.1 Condition of Existing materials. Existing materials used as part of the required vertical load-carrying or lateral force-resisting system shall be in sound condition, or shall be repaired or removed and replaced with new materials. All other unreinforced masonry materials shall comply with the following requirements:

1. The lay-up of the masonry units shall comply with Section A106.3.2, and the quality of bond between the units has been verified to the satisfaction of the building official;

2. Concrete masonry units are verified to be load bearing units complying with ASTM C 90 or such other standard as is acceptable to the building official; and

3. The compressive strength of plain concrete walls shall be determined based on cores taken from each class of concrete wall. The location and number of tests shall be the same as those prescribed for tensile-splitting strength tests in Sections A106.3.3.3 and A106.3.3.4, or in Section A108.1.

The use of materials not specified herein or in Section A108.1 shall be based on substantiating research data or engineering judgment, with the approval of the building official.

Existing materials used as part of the required vertical load-carrying or seismic force-resisting system shall be evaluated by on-site investigation and determined not to be in poor condition including degraded mortar, degraded masonry units, or significant cracking; or shall be repaired, enhanced, retrofitted or replaced and replaced with new materials. Mortar joint deterioration shall be patched by pointing or re-pointing of the eroded joint in accordance with Section A106.2.3.9. Existing significant cracks in solid unit unreinforced and in solid grouted hollow unit masonry shall be repaired by epoxy pressure injection and/ or by fiber sheets bonded by epoxy to masonry surface.

Revise as follows:

[BS] A106.3 A106.2 Existing unreinforced masonry.

[BS] A106.3.1 A106.2.1 General. Unreinforced masonry walls used to carry support vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. All masonry Masonry that does not meet the minimum standards requirements established by this chapter shall be repaired, enhanced, removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.
[BS] **A106.3.2 A106.2.2** Lay-up of walls. Unreinforced masonry walls shall be laid in a running bond pattern.

[BS] **A106.3.2-1 Multiwythe** **Header in multi-wythe solid brick.** The facing and backing wythes of multi-wythe walls shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing wythes. The clear distance between adjacent full-length headers header courses shall not exceed 24 inches (610 mm) vertically or horizontally. Where the backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers with their for which the area and spacing conforming conform to the foregoing. Wythes of walls not bonded as described above meeting these requirements shall be considered veneer. Veneer wythes shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity strength of the wall.

**Exception:** Where $S_{D1}$ is not more than 0.3 $0.3g$ or less, veneer wythes anchored as specified in the building code and made composite with backup masonry may are permitted to be used for calculation of the effective thickness.

[BS] **A106.3.2-2 A106.2.2.2** Grouted or ungrouted hollow concrete or clay block. Concrete masonry units and structural hollow clay load-bearing tile. Grouted or ungrouted hollow concrete masonry units shall be tested in accordance with ASTM C140. Grouted or ungrouted structural clay block and structural hollow clay load-bearing tile shall be laid tested in a running bond pattern accordance with ASTM C34.

[BS] **A106.3.2-3 A106.2.2.3** Other lay-up patterns. Lay-up patterns other than those specified in Sections A106.3.2.1 and A106.3.2.2 above are. Section A106.2.2.1 is allowed if their performance can be justified.

[BS] **A106.3.3 A106.2.3** Testing of masonry.

Delete and substitute as follows:

[BS] **A106.3.3-1 A106.2.3.1** Mortar In-place mortar tests. The quality of mortar in all masonry walls shall be determined by performing in-place shear tests in accordance with the following:

1. The bed joints of the outer wythe of the masonry shall be tested in shear by laterally displacing a single brick relative to the adjacent brick in the same wythe. The head joint opposite the loaded end of the test brick shall be carefully excavated and cleared. The brick adjacent to the loaded end of the test brick shall be carefully removed by sawing or drilling and excavating to provide space for a hydraulic ram and steel loading blocks. Steel blocks, the size of the end of the brick, shall be used on each end of the ram to distribute the load to the brick. The blocks shall not contact the mortar joints. The load shall be applied horizontally, in the plane of the wythe. The load recorded at first movement of the test brick as indicated by spalling of the face of the mortar bed joints is $V_{test}$ in Equation A1-3.

2. Alternative procedures for testing shall be used where in-place testing is not practical because of crushing or other failure mode of the masonry unit (see Section A106.3.3.2):

<table>
<thead>
<tr>
<th>Mortar shear test values, $v_{top}$, shall be obtained by one of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ASTM C1531.</td>
</tr>
<tr>
<td>2. For masonry walls that have high shear strength mortar, or where in-place testing is not practical because of crushing or other failure mode of the masonry, alternative procedures for testing shall be used in accordance with Section A106.2.3.2.</td>
</tr>
</tbody>
</table>

Revise as follows:

[BS] **A106.3.3.2 A106.2.3.2** Alternative procedures for testing masonry. The tensile-splitting strength of existing masonry, $f_{sp}$, or the prism strength of existing masonry, $f_{pM}$, may is permitted to be determined in accordance with one of ASTM C496 and calculated by the following procedures equation:

1. Wythes of solid masonry units shall be tested by sampling the masonry by drilled cores of not less than 8 inches (203 mm) in diameter. A bed joint intersection with a head joint shall be in the center of the core. The tensile-splitting strength of these cores should be determined by the standard test method of ASTM C 496. The core should be placed in the test apparatus with the bed joint 45 degrees (0.79 rad) from the horizontal. The tensile-splitting strength should be determined by the following equation:

$$ f_{sp} = \frac{2P}{\pi d} $$  \quad (Equation A1-4)

2. Hollow unit masonry constructed of through-the-wall units shall be tested by sampling the masonry by a sawn square prism of not less than 18 inches square (11 613 mm$^2$). The tensile-splitting strength should be determined by the standard test method of ASTM E 519. The diagonal of the prism shall be placed in a vertical position. The tensile-splitting strength should be determined by the following equation:

$$ f_{sp} = \frac{0.49P}{\pi d} $$  \quad (Equation A1-2)
3. An alternative to material testing is estimation of the $f''_{m}$ of the existing masonry. This alternative should be limited to recently constructed masonry. The determination of $f''_{m}$ requires that the unit correspond to a specification of the unit by an ASTM standard and classification of the mortar by type.

$$f''_{m} = \frac{0.49 V}{d_{a}} \quad (\text{Equation A1-1})$$

[BS] A106.3.3  Location of tests. The shear tests shall be taken at locations representative of the mortar conditions throughout the entire building, taking into account variations in workmanship at different building height levels, variations in weathering of the exterior surfaces, and variations in the condition of the interior surfaces due to deterioration caused by leaks and condensation of water and/or by the deleterious effects of other substances contained within the building. The exact test locations shall be determined at the building site by the engineer or architect, registered design professional in responsible charge of the structural design work. An accurate record of all such tests and their locations in the building shall be recorded, and these results shall be submitted to the building department for approval as part of the structural analysis.

[BS] A106.3.4  Number of tests. The minimum number of tests per masonry class shall be determined as follows:

1. At each of both the first and top stories, not less than two tests per wall or line of wall elements providing a common line of resistance to lateral seismic forces.
2. At each of all other stories, not less than one test per wall or line of wall elements providing a common line of resistance to lateral seismic forces.
3. In any case, not less than one test per 1,500 square feet (139.4 m$^2$) of wall surface and not less than a total of eight tests.

[BS] A106.3.5  Minimum quality of mortar.

1. Mortar shear test values, $v_{to}$, in pounds per square inch (kPa) shall be obtained for each in-place shear test in accordance with the following equation:

$$v_{to} = \frac{(V_{test}/A_{b}) \cdot P_{D+L}}{D} \quad (\text{Equation A1-3})$$

Where,

$V_{test}$ = Load at first observed movement;

$A_{b}$ = Total area of the bed joints above and below the test specimen;

$P_{D+L}$ = Stress resulting from actual dead plus live loads in place at the time of testing

2. Individual unreinforced masonry walls with more than 50% of mortar test values, $v_{tL}$, consistently less than 30 pounds per square inch (207 kPa) shall be entirely pointed prior to and retested.

3. The lower-bound mortar shear strength, $v_{L}$, is the value in pounds per square inch (kPa) that is exceeded by 80 percent defined as $v_{to}$ minus one standard deviation of the mortar shear test values, $v_{to}$.

4. Unreinforced masonry with mortar shear strength, $v_{L}$, less than 30 pounds per square inch (207 kPa) shall be removed, pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements in accordance with Sections A106.3.1 and A113.8. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent bed joints of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be no greater than that of the weakest wythe of that class.

[BS] A106.3.6  Minimum quality of masonry.

1. The minimum average value of tensile-splitting strength determined by Equation A1-1 or A1-2 shall be 50 pounds per square inch (344.7 kPa). The minimum value of $f''_{m}$, determined by categorization of the masonry units and mortar should be 1,000 pounds per square inch (6895 kPa).

2. Individual unreinforced masonry walls with average tensile-splitting strength, $f_{sp}$, of less than 50 pounds per square inch (344.7 kPa) shall be entirely pointed prior to retesting.

3. Hollow unit unreinforced masonry walls with estimated prism compressive strength of less than 1,000 pounds per square inch (6895 kPa) shall be grouted to increase the average net area compressive strength.

4. The lower-bound mortar shear strength, $f_{spL}$, is defined as the mean minus one standard deviation of the tensile-splitting strength test values, $f_{sp}$.

[BS] A106.3.7  Collar joints. The collar joints shall be inspected at the test locations during each in-place shear test, and estimates of the percentage of surfaces of the adjacent wythe surfaces wythes that are covered with mortar shall be...
reported along with the results of the in-place shear tests.

[BS] A106.3.9.8 A106.2.3.8 Unreinforced masonry classes. Existing unreinforced masonry shall be categorized into one or more classes based on shear strength, quality of construction, state of repair, deterioration and weathering. A class shall be characterized by the allowable masonry shear stress, determined in accordance with Section A108.2. Classes shall be defined for whole walls, not for small areas of masonry within a wall. Discretion in the definition of classes of masonry is permitted to avoid unnecessary testing.

[BS] A106.3.9.9 A106.2.3.9 Pointing. Deteriorated mortar joints in unreinforced masonry walls shall be pointed in accordance with the following requirements:

1. **Joint preparation.** The deteriorated mortar shall be cut out by means of a toothing chisel or non-impact power tool to a depth at which sound mortar is reached but to a depth of not less than \( \frac{3}{4} \) inch (19.1 mm) or twice the thickness of the joint, whichever is less, and 2 inches (50 mm) maximum. Care shall be taken not to damage the brick or masonry edges. After cutting is complete, all loose material shall be removed with a brush, air stream or water stream.

2. **Mortar preparation.** The mortar mix shall be proportioned as required by the registered design professional construction specifications. The pointing mortar shall be prehydrated by first thoroughly mixing all ingredients dry and then mixing again, adding only enough water to produce a damp workable mix which will retain its form when pressed into a ball. The mortar shall be kept in a damp condition for not less than one hour and not more than \( 1 \frac{1}{2} \) hours for pre-hydration; then sufficient water shall be added to bring it to a workable consistency for pointing which is somewhat drier than conventional masonry mortar. Use mortar within one and two and one-half hours from its initial mixing.

3. **Packing.** The joint into which the mortar is to be packed shall be dampened but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding \( \frac{3}{4} \) inch (6.4 mm) in depth deep until it is filled; then it shall be tooled to a smooth surface to match the original profile.

Nothing shall prevent pointing of any deteriorated masonry wall joints before testing is performed in accordance with Section A106.3.9 A106.2.3, except as required in Section A107.1.

### SECTION A107 QUALITY CONTROL

[BS] A107.3 Existing wall anchors. Existing wall anchors used as all or part of the required tension anchors shall be tested in pullout according to Section A107.5.1. The minimum number of four anchors tested per floor shall be four per floor tested in pullout, with a minimum of two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

[BS] A107.4 New bolts wall anchors. All new wall anchors embedded bolts in URM walls shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt anchor and grout or adhesive in the drilled hole. Five percent of all bolts anchors that do not extend through the wall shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5. New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

- **Exception:** Special inspection in accordance with the building code may be provided during installation of new anchors in lieu of testing.

All new wall anchors, embedded bolts in URM walls resisting tension forces or a combination of tension and shear forces shall be subject to periodic special inspection in accordance with the building code, prior to placement of the bolt anchor and grout or adhesive in the drilled hole. Five percent of all bolts anchors resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5.

- **Exception:** New through bolts bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

[BS] A107.5 Tests of anchors in unreinforced masonry walls. Tests of anchors in unreinforced masonry walls shall be in accordance with Sections A107.5.1 through A107.5.4. Results of all tests shall be reported to the authority having jurisdiction. The report shall include the test results of maximum load for each test, pass/fail results and also include: corresponding anchor size and type, orientation of loading, details of the anchor installation, testing apparatus, and embedment, wall thickness, and joint orientation and proximity to the tested anchor.

[BS] A107.5.1 Direct tension testing of existing anchors and new bolts anchors. The test apparatus shall be supported by the masonry wall. The distance between the anchor test procedure for pre-qualification of tension and the test apparatus support shear anchors shall be not less than one-half the wall thickness for existing anchors and 75 percent of the embedment for new embedded bolts comply with ASTM E488. Existing wall anchors shall be given a preload of 300 pounds (1335 N) prior to
before establishing a datum for recording elongation. The tension test load reported shall be recorded at \( \frac{1}{8} \) inch (3.2 mm) relative movement between the existing anchor and the adjacent masonry surface. New embedded tension bolts anchors shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for five minutes (10 percent deviation).

**Exception:** Where obstructions occur, the distance between the anchor and the test apparatus support shall be not less than one-half the wall thickness for existing anchors and 75 percent of the embedment length for new embedded anchors.

**[BS] A107.5.2 Torque testing of new bolts anchors.** Bolts Anchors embedded in unreinforced masonry walls shall be tested using a torque-calibrated wrench to the following minimum torques:
- \( \frac{1}{4} \) -inch-diameter (12.7 mm) bolts: 40 foot pounds (54.2 N-m).
- \( \frac{5}{8} \) -inch-diameter (15.9 mm) bolts: 50 foot pounds (67.8 N-m).
- \( \frac{3}{4} \) -inch-diameter (19.1 mm) bolts: 60 foot pounds (81.3 N-m).

**[BS] A107.5.3 Prequalification tests for bolts and other types of non-conforming anchors.** This section ASTM E488 or the test procedure in Section A107.5.1 is applicable when it is desired permitted to use be used to determine tension or shear strength values for anchors greater than those permitted by Table A1-E. The direct-tension test procedure set forth in Section A107.5.1 for existing anchors shall be used to determine the allowable tension values for new embedded through bolts, except that no preload is required. Bolts Anchors shall be installed in the same manner and using the same materials as will be used in the actual construction. A minimum of five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The allowable tension and shear strength values for such anchors shall be the lesser of the average ultimate load divided by a safety factor of 5.0 or the average load at which \( \frac{1}{8} \) inch (3.2 mm) elongation occurs for each size and type of bolt anchor and class of masonry.

The allowable values determined in this manner shall be permitted to exceed those set forth in Table A1-E.

Delete without substitution:

**[BS] A107.5.4 - Reports.** Results of all tests shall be reported. The report shall include the test results as related to anchor size and type, orientation of loading, details of the anchor installation and embedment, wall thickness and joist orientation.

**SECTION A108 DESIGN STRENGTHS**

**Revise as follows:**

**[BS] A108.1 Strength Values.**

1. Strength values for existing materials are given in Table A1-D and for new materials in Table A1-E.
2. Capacity reduction factors need not be used.
3. The use of new materials not specified herein shall be based on substantiating research data or engineering judgment, with the approval of the building official.
4. The strength reduction factor, \( \Phi \), shall be taken equal to 1.0.
5. The use of materials not specified herein shall be subjected to the discretion and approval of the authority having jurisdiction.

**[BS] A108.2 Masonry shear strength.** The unreinforced masonry shear strength, \( v_m \), shall be determined for each masonry class from one of the following equations:

1. The unreinforced masonry shear strength, \( v_m \), shall be determined by Equation A1-4 when the mortar shear strength has been determined by Section 106.3.3.1.

   \[
   v_m = 0.56v_t + 0.75v_p \quad (\text{Equation A1-4})
   \]

   The mortar shear strength values, \( v_t \), shall be determined in accordance with Section 106.3.3.

2. The unreinforced masonry shear, \( v_m \), shall be determined by Equation A1-5 when tensile-splitting strength has been determined in accordance with Section 106.3.3.2, Item 1 or 2.

   \[
   v_m = 0.56v_t + \frac{0.25F_{sp}}{d} \quad (\text{Equation A1-5})
   \]

3. When \( F_{sp} \) has been estimated by categorization of the units and mortar in accordance with Section 2105.1 of the International Building Code, the unreinforced masonry shear strength, \( v_m \), shall not exceed 200 pounds per square inch (1380 kPa) or the lesser of the following:
   a) \( \frac{v_m}{5} \)
   b) 200 psi
   c) 200 psi
c) \[ v + 0.75 \frac{F_I}{A} \]  \hspace{1cm} \text{(Equation A1-6)}

For SI: 1 psi = 6.895 kPa.

where:

\[ v = 62.5 \text{ psi (430 kPa)} \] for running bond masonry not grouted solid.

\[ v = 100 \text{ psi (690 kPa)} \] for running bond masonry grouted solid.

\[ v = 25 \text{ psi (170 kPa)} \] for stack bond grouted solid.

1. When testing is performed in accordance with Section A106.2.3.1, the unreinforced masonry shear strength, \( v_{mL} \), shall be determined by Equation A1-3:

\[ \text{(Equation A1-3)} \]

The mortar shear strength values, \( v_m \), shall be determined in accordance with Section A106.2.3.5.

2. When alternate testing is performed in accordance with Section A106.2.3.2, unreinforced masonry shear, \( v_{mL} \), shall be determined by Equation A1-4.

\[ \text{(Equation A1-4)} \]

3. \hspace{1cm} \[ \text{[BS]} \text{ A108.3 Masonry compression.} \text{ Where any increase in wall dead plus live load compression stress occurs, the maximum compression stress in unreinforced masonry, } \frac{Q_g}{A_w} \text{ shall not exceed 300 pounds per square inch (2070 kPa).} \]

4. \hspace{1cm} \[ \text{[BS]} \text{ A108.4 Masonry tension.} \text{ Unreinforced masonry shall be assumed to have no tensile capacity.} \]

5. \hspace{1cm} \[ \text{[BS]} \text{ A108.5 Existing Wall tension anchors.} \text{ The resistance values, tension strength of the existing wall anchors shall be the average of the tension test values for anchors having the same wall thickness and joint framing orientation.} \]

6. \hspace{1cm} \[ \text{[BS]} \text{ A108.6 Foundations.} \text{ For existing foundations, new total dead loads may be increased over the existing dead load by 25 percent. New total dead load plus live load plus seismic forces may be increased over the existing dead load plus live load by 50 percent. Higher values may be justified only in conjunction with a geotechnical investigation.} \]

SECTION A109 ANALYSIS AND DESIGN PROCEDURE

7. \hspace{1cm} \[ \text{[BS]} \text{ A109.1 General.} \text{ The elements of buildings hereby required to be analyzed are specified in Table A1-A.} \]

8. \hspace{1cm} \[ \text{[BS]} \text{ A109.2 Selection of procedure.} \text{ Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110, which is based on the building code. Buildings with flexible diaphragms shall be analyzed by the general procedure or, when applicable, may be analyzed by the special procedure of Section A111. ASCE 41 is permitted to be used as an alternate procedure for both rigid diaphragm or flexible diaphragm buildings.} \]

SECTION A110 GENERAL PROCEDURE

9. \hspace{1cm} \[ \text{[BS]} \text{ A110.1 Minimum design lateral forces.} \text{ Buildings shall be analyzed to resist minimum lateral forces assumed to act nonconcurrently in the direction of each of the main axes of the structure in accordance with the following:} \]

\[ v = 0.75 \frac{F_I}{R} \]  \hspace{1cm} \text{(Equation A1-7 A1-5)}

10. \hspace{1cm} \[ \text{[BS]} \text{ A110.2 Lateral Seismic forces on elements of structures.} \text{ Parts and portions of a structure not covered in Section A110.3 shall be analyzed and designed per the current building code, using force levels defined in Section A110.1.} \]

Exceptions:

1. Unreinforced masonry walls for which height-to-thickness ratios do not exceed ratios set forth in Table A1-B need not be analyzed for out-of-plane loading. Unreinforced masonry walls that exceed the allowable \( h/t \) ratios of Table A1-B shall be braced according to Section A113.5.

2. Parapets complying with Section A113.6 need not be analyzed for out-of-plane loading.

3. Where walls are to be anchored to flexible floor and roof diaphragms, the anchorage shall be in accordance with Section A113.1.

11. \hspace{1cm} \[ \text{[BS]} \text{ A110.3 In-plane loading of URM shear walls and frames.} \text{ Vertical lateral load-resisting seismic force-resisting elements shall be analyzed in accordance with Section A112.} \]

12. \hspace{1cm} \[ \text{[BS]} \text{ A110.4 Redundancy and overstrength factors.} \text{ Any redundancy or overstrength factors contained in the building code may be taken as unity. The vertical component of earthquake load seismic force } (E_v E_I) \text{ may be taken as zero.} \]

SECTION A111 SPECIAL PROCEDURE

13. \hspace{1cm} \[ \text{[BS]} \text{ A111.1 Limits for the application of this procedure.} \text{ The special procedures of this section may be applied only to buildings having the following characteristics:} \]

1. Flexible diaphragms at all levels above the base of the structure.

2. Vertical elements of the lateral seismic force-resisting system consisting predominantly of masonry or combination of...
3. Except for single-story buildings with an open front on one side only, a minimum of two lines of vertical elements of the lateral seismic force-resisting system parallel to each axis of the building (see Section A111.8 for openfront buildings).

[BS] A111.2 Lateral Seismic forces on elements of structures. With the exception of the provisions in Sections A111.4 through A111.7, elements of structures and nonstructural elements shall comply with Sections A110.2 through A110.4 the reduced level seismic forces prescribed in IEBC section 301.1.4.2.

[BS] A111.3 Crosswalls. Crosswalls shall meet the requirements of this section.

[BS] A111.3.1 Crosswall definition. A crosswall is a wood-framed wall sheathed with any of the materials described in Table A1-D or A1-E or other system as defined in Section A111.3.5. Crosswalls shall be spaced no more than 40 feet (1219 mm) on center measured perpendicular to the direction of consideration, and shall be placed in each story of the building. Crosswalls shall extend the full story height between diaphragms.

Exceptions:
1. Crosswalls need not be provided at all levels when used in accordance with Section A111.4.2, Item 4.
2. Existing crosswalls need not be continuous below a wood diaphragm at or within 4 feet (1219 mm) of grade, provided:
   2.1. Shear connections and anchorage requirements of Section A111.5 are satisfied at all edges of the diaphragm.
   2.2. Crosswalls with total shear capacity of 0.5 \( S \Sigma W \) interconnect the diaphragm to the foundation.
   2.3. The demand-capacity ratio of the diaphragm between the crosswalls that are continuous to their foundations does not exceed 2.5, calculated as follows:
   \[
   DCR = \frac{(2.1 S \Sigma W + V_{cb})}{2vD}
   \]  
   (Equation A1-8)  

[BS] A111.4 Wood diaphragms.

[BS] A111.4.1 Acceptable diaphragm span. A diaphragm is acceptable if the point \((L, DCR)\) on Figure A1-1 falls within Region 1, 2 or 3.

[BS] A111.4.2 Demand-capacity ratios. Demand-capacity ratios shall be calculated for the diaphragm at any level according to the following formulas:

1. For a diaphragm without qualifying crosswalls at levels immediately above or below:
   \[
   DCR = 2.1 S D1 \Sigma v u D
   \]  
   (Equation A1-7)

2. For a diaphragm in a single-story building with qualifying crosswalls, or for a roof diaphragm coupled by crosswalls to the diaphragm directly below:
   \[
   DCR = 2.1 S D1 \Sigma v u D + V_{cb}
   \]  
   (Equation A1-10 A1-8)

3. For diaphragms in a multistory building with qualifying crosswalls in all levels:
   \[
   DCR = 2.1 S D1 \Sigma W / (\Sigma v u D + V_{cb})
   \]  
   (Equation A1-14 A1-9)

   \( DCR \) shall be calculated at each level for the set of diaphragms at and above the level under consideration. In addition, the roof diaphragm shall also meet the requirements of Equation A1-10 A1-8 .

4. For a roof diaphragm and the diaphragm directly below, if coupled by crosswalls:
   \[
   DCR = 2.1 S D1 \Sigma W / (\Sigma v u D)
   \]  
   (Equation A1-12 A1-10)

[BS] A111.5 Diaphragm shear transfer. Diaphragms shall be connected to shear walls and new vertical seismic force-resisting elements with connections capable of developing the diaphragm-loading tributary to the shear wall or new seismic force-resisting elements given by the lesser of the following formulas:

\( V = 1.2 S D1 C p W_d \)  
(\text{Equation A1-13 A1-11})

using the \( C_p \) values in Table A1-C, or

\( V = v_D \)  
(\text{Equation A1-14 A1-12})

[BS] A111.6 Shear walls (In-plane loading).

[BS] A111.6.1 Wall story force. The wall story force distributed to a shear wall at any diaphragm level shall be the lesser value
calculated as:
\[ F_{wx} = 0.8 \frac{S D_1}{W_{wx} + W_d/2} \]  \hspace{1cm} (Equation A1-15 A1-13)
but need not exceed
\[ F_{wx} = 0.8 \frac{S D_1(W_{wx} + v D)}{v D} \]  \hspace{1cm} (Equation A1-16 A1-14)

[BS] A111.6.2 Wall story shear. The wall story shear shall be the sum of the wall story forces at and above the level of consideration.
\[ V_{wx} = \Sigma F_{wx} \]  \hspace{1cm} (Equation A1-17 A1-15)

[BS] A111.6.3 Shear wall analysis. Shear walls shall comply with Section A112.

[BS] A111.6.4 Moment frames. New seismic force-resisting elements. Moment frames. New seismic force-resisting elements such as moment frames, braced frames used in place of or shear walls shall be designed as required by the building code, except that the seismic forces shall be as specified in Section A111.6.1, and the story drift ratio shall be limited to 0.015, except as further limited by Section A112.4.2 for moment frames.

[BS] A111.8 Open-front design procedure. A single-story building with an open front on one side and crosswalls parallel to the open front may be designed by the following procedure:
1. Effective diaphragm span, \( L_i \), for use in Figure A1-1 shall be determined in accordance with the following formula:
\[ L_i = 2\left( \frac{W_w}{W_d} \right) L + L \]  \hspace{1cm} (Equation A1-18 A1-16)
2. Diaphragm demand-capacity ratio shall be calculated as:
\[ \text{DCR} = 2.1 \frac{S D_1(W_d + W_w)/[v D + V_{cd}]}{V} \]  \hspace{1cm} (Equation A1-19 A1-17)

SECTION A112 ANALYSIS AND DESIGN

[BS] A112.1 General. The following requirements are applicable to both the general procedure and the special procedure for analyzing vertical elements of the lateral force-resisting system.

[BS] A112.2 Existing. In-plane shear of unreinforced masonry walls. Flexural rigidity. Flexural components of deflection may be neglected in determining the rigidity of an unreinforced masonry wall.

[BS] A112.2.1 Shear walls with openings. Wall piers shall be analyzed according to the following procedure, which is diagrammed in Figure A1-2.
1. For any pier,
   1.1. The pier shear capacity shall be calculated as:
   \[ V_a = v_m A_\frac{P D}{H} \]  \hspace{1cm} (Equation A1-20 A1-18)
   Where \( A = \) area of net mortared or grouted section of a wall or wall pier
   1.2. The pier rocking shear capacity shall be calculated as:
   \[ V_r = 0.9 \frac{P D}{H} \]  \hspace{1cm} (Equation A1-24 A1-19)
2. The wall piers at any level are acceptable if they comply with one of the following modes of behavior:
   2.1. Rocking controlled mode. When the pier rocking shear capacity is less than the pier shear capacity, i.e., \( V_r < V_a \) for each pier in a level, forces in the wall at that level, \( V_{wx} \), shall be distributed to each pier in proportion to \( P D/H \). For the wall at that level:
   \[ 0.7V_{wx} < \Sigma V \]  \hspace{1cm} (Equation A1-22 A1-20)
   2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity, i.e., \( V_a < V_r \) in at least one pier in a level, forces in the wall at the level, \( V_{wx} \), shall be distributed to each pier in proportion to \( D/H \). For each pier at that level:
   \[ V_P < V_a \]  \hspace{1cm} (Equation A1-23 A1-21)
   and
   \[ V_P < V_r \]  \hspace{1cm} (Equation A1-24 A1-22)
   If \( V_P < V_a \) for each pier and \( V_P > V_r \) for one or more piers, such piers shall be omitted from the analysis, and the procedure shall be repeated for the remaining piers, unless the wall is strengthened and reanalyzed.
3. Masonry pier tension stress. Unreinforced masonry wall piers need not be analyzed for tension stress.

[BS] A112.2.3 Shear walls without openings. Shear walls without openings shall be analyzed the same as for walls with openings, except that \( V_a \) shall be calculated as follows:
\[ V_r = 0.9 \left( P_D + 0.5 P_w \right) D/H \]  \hspace{1cm} (Equation A1-25 A1-23)

[BS] A112.3 Plywood-sheathed shear walls. Plywood-sheathed
Plywood-sheathed shear walls may be used to resist lateral forces for URM buildings with flexible diaphragms analyzed according to provisions of Section A111. Plywood-sheathed shear walls may not be used to share lateral forces with other materials along the same line of resistance.

[BS] A112.4 Combinations of vertical elements.

[BS] A112.4.1 Lateral-force Seismic-force distribution. Lateral Seismic forces shall be distributed among the vertical-resisting elements in proportion to their relative rigidities, except that moment-resisting frames shall comply with Section A112.4.2.

[BS] A112.4.2 Moment-resisting frames. Moment-resisting Moment-resisting frames shall not be used with an unreinforced masonry wall in a single line of resistance unless the wall has piers that have adequate shear capacity to sustain rocking in accordance with Section A112.2.2. The frames shall be designed in accordance with the building code to carry 100 percent of the lateral seismic forces tributary to that line of resistance, as determined from Equation A1-7 Section A111.2. The story drift ratio shall be limited to 0.0075.

SECTION A113 DETAILED BUILDING SYSTEM DESIGN REQUIREMENTS

[BS] A113.1.2 Anchor requirements. Anchors shall consist of bolts installed through the wall as specified in Table A1-E, or an approved equivalent at a maximum anchor spacing of 6 feet (1829 mm). All wall anchors shall be secured to the joists framing members parallel or perpendicular to the wall to develop the required forces.

[BS] A113.1.3 Minimum wall anchorage. Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as 0.9S ρS times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must be tested and meet the requirements of this chapter Section A107.5.1 or must be upgraded.

[BS] A113.2 Diaphragm shear transfer. Anchors transmitting shear forces shall have a maximum bolt spacing of 6 feet (1829 mm) and shall have nuts installed over malleable iron or plate washers when bearing on wood, and heavy-cut washers when bearing on steel.

[BS] A113.6 Parapets. Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions. The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A1-F. If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code shall support the top of the parapet. Parapet corrective work must be performed in conjunction with the installation of tension roof anchors.

The minimum height of a URM parapet above any wall anchor shall be 12 inches (305 mm).

Exception: If a reinforced concrete beam is provided at the top of the wall, the minimum height above the wall anchor may be permitted to be 6 inches (152 mm).

TABLE 0 A1-B

<table>
<thead>
<tr>
<th>WALL TYPES</th>
<th>0.13gSD1g</th>
<th>0.25gSD1g</th>
<th>0.4gSD1g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings with crosswalls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls of one-story buildings</td>
<td>20</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>First-story wall of multistory building</td>
<td>20</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Walls in top story of multistory building</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>All other walls</td>
<td>20</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

a. Applies to the special procedures of Section A111 only. See Section A111.7 for other restrictions.
b. This value of height-to-thickness ratio may be used only where mortar shear tests establish a tested mortar shear strength, $\nu_T$ of not less than 100 pounds per square inch (690 kPa). This value may also be used where the tested mortar shear strength is not less than 60 pounds per square inch (414 kPa), and where a visual examination of the collar joint indicates not less than 50-percent mortar coverage.
c. Where a visual examination of the collar joint indicates not less than 50-percent mortar coverage, and the tested mortar shear strength, $\nu_T$ is greater than 30 pounds per square inch (207 kPa) but less than 60 pounds per square inch (414 kPa), the allowable height-to-thickness ratio may be determined by linear interpolation between the larger and smaller ratios in direct proportion to the tested mortar shear strength.
## STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION

<table>
<thead>
<tr>
<th>NEW MATERIALS OR CONFIGURATION OF MATERIALS</th>
<th>STRENGTH VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal diaphragms</td>
<td>675 lbs. per ft.</td>
</tr>
<tr>
<td>Plywood sheathing applied directly over existing straight sheathing with ends of plywood sheets bearing on joists or rafters and edges of plywood located on center of individual sheathing boards.</td>
<td>1.2 times the value specified in the current building code.</td>
</tr>
<tr>
<td>Crosswalls</td>
<td>The value specified in the current building code.</td>
</tr>
<tr>
<td>Plywood sheathing applied directly over wood studs; no value should be given to plywood applied over existing plaster or wood sheathing.</td>
<td>50 percent of the value specified in the current building code.</td>
</tr>
<tr>
<td>Drywall or plaster applied directly over wood studs.</td>
<td></td>
</tr>
<tr>
<td>Drywall or plaster applied to sheathing over existing wood studs.</td>
<td></td>
</tr>
<tr>
<td>Tension bolt anchors</td>
<td>5,400 lbs. per bolt anchor for three wythe minimum walls.</td>
</tr>
<tr>
<td>Bolts extending entirely through unreinforced masonry wall secured with bearing plates on far side of a three-wythe minimum wall with at least 30 square inches of area.</td>
<td>2,700 lbs. for two-wythe walls.</td>
</tr>
<tr>
<td>Shear bolt anchors</td>
<td>The value for plain masonry specified for solid masonry in the current building code TMS 402 no value larger than those given for 3/4-inch bolts should be used.</td>
</tr>
<tr>
<td>Bolts embedded a minimum of 8 inches into unreinforced masonry walls; anchors should be centered in 2 1/2-inch-diameter holes with dry-pack or nonshrink grout around the circumference of the anchor.</td>
<td></td>
</tr>
<tr>
<td>Combined tension and shear bolt anchors</td>
<td>Tension—same as for tension bolt anchors.</td>
</tr>
<tr>
<td>Through bolt anchors—bolt anchors meeting the requirements for shear and for tension anchors.</td>
<td>Shear—same as for shear bolt anchors.</td>
</tr>
<tr>
<td>Embedded bolt anchors—bolt anchors extending to the exterior face of the wall with a 2 1/2-inch round plate under the head and drilled at an angle of 22 1/2 degrees to the horizontal; installed as specified for shear bolt anchors.</td>
<td>Tension—3,600 lbs. per bolt anchor.</td>
</tr>
<tr>
<td>Infilled walls</td>
<td>Shear—same as for shear bolt anchors.</td>
</tr>
<tr>
<td>Reinforced masonry</td>
<td>Same as values specified for unreinforced masonry walls.</td>
</tr>
<tr>
<td>Masonry piers and walls reinforced per the current building code.</td>
<td>The value specified in the current building code for strength design.</td>
</tr>
<tr>
<td>Reinforced concrete</td>
<td>The value specified in the current building code for strength design.</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 pound = 4.4 N.

a. Embedded bolt anchors to be tested as specified in Section A107.4.

b. Bolt anchors shall be 1/2 inch minimum in diameter.

c. Drilling for bolt and dowel anchors shall be done with an electric rotary drill; impact tools should not be used for drilling holesor tightening anchors and shear bolt nuts.

d. No load factors or capacity reduction factor shall be used.

e. Other bolt sizes, values and installation methods may be used, provided a testing program is conducted in accordance with Section A107.5.3. The strength value shall be determined by multiplying the calculated allowable value, determined in accordance with Section A107.5.3, by 3.0, and the usable value shall be limited to a maximum of 1.5 times the value given in the table. Bolt spacing shall not exceed 6 feet on center and shall be not less than 12 inches on center.

f. An alternative adhesive anchor bolt system is permitted to be used providing: a) Its properties and installation conform to an ICC Evaluation Service Report; and b) The Report states that the system’s use is in unreinforced masonry as an acceptable alternative to Sections A107.4, A113.1, or TMS 402 Section 2.1.4. The Report’s allowable values shall be multiplied by a factor of 3 to obtain strength values and the strength reduction factor Φ shall be taken equal to 1.0.

Reference standards type: This reference standard is new to the ICC Code Books

Add new standard(s) as follows:

ASTM C1531-15, Standard Test Methods for In Situ Measurement Of Masonry Mortar Joint Shear Strength Index

Reason: Appendix A1 was first introduced to the legacy code UCBC by the proponent (SEAOC) in or about 1990. During the intervening years, varies standards have been developed with practical considerations to users of the Appendix A1 in retrofitting URM buildings. Appendix A1 closely aligns with the ASCE 41-13 in Reduced Performance Objective, a Collapse Prevention Performance level (S-5) for BSE-1E Seismic Hazard Level demands. The special procedure under Appendix A1 is consistent.
with the Tier 2 deficiency-based procedures of ASCE 41-13 Chapter 5 for this Performance Objective. An Ad Hoc Committee was convened under the direction of SEAOC Existing Building Committee. The Ad Hoc Committee was chaired by Fred Turner, Staff Structural Engineer with the California Alfred E. Alquist Seismic Safety Commission, and who also chairs ASCE 41-17 Masonry Team. Participants in the Ad Hoc Committee includes delegates from Structural Engineers Associations of California and of Washington. The proposed modifications are essentially editorial, including removal of text where ASTM standards are available, and coordination between the Appendix A1 and ASCE 41 chapter 15. A brief summary of the proposed modifications are listed below:

Section A102, Scope. Proposes adding a story height restriction to be consistent with ASCE 41 Chapter 15 and Table 3-2.

Section A103, Definitions. Revisions proposed to improve consistency and eliminate discrepancies with ASCE 41 and TMS 402 definitions.

Section A104, Symbols and Notations. Revisions proposed for consistency and elimination of discrepancies with ASCE 41 and TMS 402 definitions.

Section A105, General Requirements. Added “and referenced standards” to be complied with for clarification. Added construction quality assurance requirements for the plans for consistency with ASCE 41 and TMS 402.

Section A106, Material Requirements. Changes proposed for consistency with condition assessments and materials provisions in ASCE 41 Chapters 15 and 11. In A106.2.3.1 and .2, replaced text with a reference to ASTM C1531 and C496 which have more current sets of provisions. Replaced reference to ASTM C90 for concrete masonry unit buildings with C140 to broaden the options available to users, and, in particular, to address concrete masonry units that don't necessarily comply with C90; and edit sections to eliminate clauses covered in the Standards.

Section A107, Quality Control. Changes proposed for consistency with quality control provisions in ASCE 41 Chapters 15 and 11. Added reference to ASCE E488 which has a more current set of provisions than current provisions. Proposed deletion of Reports requirements in A107.5.4 since it would be addressed in new provisions of Section A105.

Section A108, Design strength. Changes proposed for consistency with design strength requirements of ASCE 41 Chapter 15. Added a 1.5 factor in the denominator of Equations A1-3 and A1-4 to be consistent with strength design, Chapters 11 and 15 of ASCE 41 to replace the 0.67 factor that is proposed to be deleted in the numerator of Equation A1-18 of Section A112, so there is no substantive effect for this change. Deletes the alternate method in Section A108.2 for estimating strength for consistency with ASCE 41 Chapters 11 and 15 since such methods are no longer considered reliable for older masonry walls.

Section A109, Analysis and Design Procedure. Proposes adding a reference to ASCE 41 as an acceptable alternate procedure and deleting the phrase “based on the building code” since it is no longer needed. ASCE 41 is a national standard for the seismic evaluation and retrofit of existing buildings. In time, ASCE 41 will be harmonized to adhere to provisions in Appendix A1.

Section A110, General Procedure. Editorial.

Section A111, Special Procedure. Proposes changes for consistency with special procedure in ASCE 41 Chapter 15. Clarifies that lateral forces on certain elements of structures are permitted to comply with reduced IBC level forces of IEBC Section 301. In Section A111.6.4 expanded the provisions to permit use of other types of vertical resisting systems than moment frames.

Section A112, Analysis and Design. Proposed minor editorial changes and revised equation A1-18 to be consistent with ASCE 41 Chapters 15 and 11 to address corresponding changes in A108 and to address conditions where masonry is partially grouted.

Section A113, Detailed System Design Requirements. Proposed minor changes for consistency with ASCE 41 Chapter 15.

Bibliography

The following resource materials are referenced in this chapter or are relevant to the subject matter addressed in this chapter.

ASCE 41, Seismic Evaluation and Retrofit of Existing Buildings, American Society of Civil Engineers, 2017.


Cost Impact: Will increase the cost of construction
No cost impact for URM buildings six stories or less. For buildings taller than six stories, the explicit limit serves to guide user to use the body of International Existing Building Code. The updated definition for unreinforced masonry wall, based on whether wall reinforcement meets the building code requirements for reinforced masonry walls, will have a cost impact. As a minimum, lightly reinforced masonry walls need to be evaluated by a design professional in meeting the minimum life-safety and performance objectives intended in the building code. This will increase the cost to engage a design professional, but will have no overall impact on construction cost.

Analysis: Staff note: A review of the standard(s) proposed for inclusion in the code, ASTM C1531-09, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2016. ASCE 41-2017 is part of the update proposal for all standards currently referenced in the codes. ASTM C140 is currently referenced in IBC and IRC, and ASTM C34 is currently referenced in the IRC.

Public Hearing Results

Committee Action: Approved as Modified

Modification:

2015 International Existing Building Code

[BS] A106.1 Condition of Existing materials. Existing materials used as part of the required vertical load-carrying or seismic force-resisting system shall be evaluated by on-site investigation and determined not to be in poor condition including degraded mortar, degraded masonry units, or significant cracking; or shall be repaired, enhanced, retrofitted or removed and replaced with new materials. Mortar joint deterioration shall be patched by pointing or re-pointing of the eroded joint in accordance with Section A106.2.3.9. Existing significant cracks in solid unit unreinforced and in solid grouted hollow unit masonry shall be repaired by epoxy pressure injection and/or by fiber sheets bonded by epoxy to masonry surface.

[BS] A106.2.3.9 Pointing. Deteriorated mortar joints in unreinforced masonry walls shall be pointed in accordance with the following requirements:

1. Joint preparation. Deteriorated mortar shall be cut out by means of a toothing chisel or non-impact power tool until sound mortar is reached but to a depth of not less than \( \frac{3}{4} \) inch (19.1 mm) or twice the thickness of the joint, whichever is less, and 2 inches (50 mm) maximum. Care shall be taken not to damage the masonry edges. After cutting is complete, all loose material shall be removed with a brush, air or water stream.

2. Mortar preparation. The mortar mix shall be proportioned as required by the construction specifications. The pointing mortar shall be prepared by first thoroughly mixing all ingredients dry and then mixing again, adding only enough water to
produce a damp unworkable mix that retains its form when pressed into a ball. The mortar shall be kept in a damp condition for not less than one hour and not more than $1\frac{1}{2}$ hours for pre-hydration; then sufficient water shall be added to bring it to a workable consistency for pointing, which is somewhat drier than conventional masonry mortar. Use mortar within one and two and one-half hours from its initial mixing.

3. **Packing.** The joint into which the mortar is to be packed shall be dampened but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding $\frac{1}{4}$ inch (6.4 mm) deep until it is filled; then it shall be tooled to a smooth surface to match the original profile.

Nothing shall prevent pointing of any masonry wall joints before testing is performed in accordance with Section A106.2.3, except as required in Section A107.1.

**[BS] A108.1 Strength values.**

1. Strength values for existing materials are given in Table A1-D and for new materials in Table A1-E.
2. The strength reduction factor, $\Phi$, shall be taken equal to 1.0.
3. The use of materials not specified herein shall be subjected to the discretion and approval of the authority having jurisdiction.

**[BS] A109.2 Selection of procedure.** Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110. Buildings with flexible diaphragms shall be analyzed by the general procedure or, when applicable, are permitted to be analyzed by the special procedure of Section A111. ASCE 41 is permitted to be used as an alternate procedure for both rigid diaphragm or flexible diaphragm buildings.

**[BS] A111.2 Seismic forces on elements of structures.** With the exception of the provisions in Sections A111.4 through A111.7, elements of structures and nonstructural elements shall comply with the reduced level seismic forces prescribed in IEBC section 301.4.2—Sections A110.2 through A110.4.

**Committee Reason:** The committee believes this update to the Appendix is badly needed. The limitation to six stories is a good safeguard. It is appropriate to coordinate the provisions with the latest edition of ASCE 41, bringing it in line with current requirements. The modification removes circular references back to ASCE 41 and Chapter 3 of the IEBC. It also removes a specific requirement for epoxy injection, allowing a more flexible response. Finally, instead of a more detailed provision that would preclude manufacturer's warranty for mortar preparation and installation, the code will stick the manufacturer's instructions.

**Assembly Action:** None

**Individual Consideration Agenda**

**Public Comment 1:**

Proponent: Maureen Traxler, representing City of Seattle Dept of Construction & Inspections (maureen.traxler@seattle.gov); Jonathan Siu (Jon.Siu@seattle.gov) requests Approve as Modified by this Public Comment.

Further Modify as Follows:

2015 International Existing Building Code

**[BS] A108.1 Strength Values.**

1. Strength values for existing materials are given in Table A1-D and for new materials in Table A1-E.
2. The strength reduction factor, $\Phi$, shall be taken equal to 1.0.
3. The use of materials not specified herein shall be based on substantiating research data or engineering judgement, as approved by the code official.

**Commenter's Reason:** The proposed modification restores the original language of Item 3 with a slight editorial modification. The phrase "substantiating research data or engineering judgment" gives the code official some guidance about when to approve materials, and gives some authority to require research or engineering data to support the use of unusual materials. The word "new" is deleted so that the item will apply to any material that isn't specified in the code.

Proposal EB2-15 in Group A established that the term "code official" would be used consistently in the IEBC instead of "building official".