2016 ICC CODE DEVELOPMENT CYCLE

UPDATES TO THE 2015 PROPOSED CHANGES TO THE INTERNATIONAL CODES

Update to the 2016 Group B – Consolidated Monograph
Updates 4/14/2016

The first errata was posted on 3/36/2016 and updated on 4/06/2016. This booklet contains only the additional errata.

First Printing

Publication Date: April 2016

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Replace the code change proposal with the following.

CE28-16

Part I:

IECC: , C202 (New), C303.1.5 (New).

Part II:

R202 (New) [IRC N1101.6 (New)], R303.1.5 (New) [IRC N1101.10.5 (New)]

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC-COMMERCIAL CODE COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent : Amanda Hickman, InterCode Incorporated, representing Reflective Insulation Manufacturers Association International (amanda@intercodeinc.com); Vickie Lovell, representing Reflective Insulation Manufacturers Association International(vickie@intercodeinc.com)

Part I

2015 International Energy Conservation Code

Add new definition as follows:

SECTION C202 DEFINITIONS

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

SECTION C202 DEFINITIONS

RADIANT BARRIER. A material having a low *emittance* surface of 0.1 or less installed in building assemblies.

Add new text as follows:

C303.1.5 Radiant barrier. The *emittance of radiant barriers shall be 0.1 or less. Radiant barriers* shall comply with ASTM C1313/C1313M.

Reference standards type: This is an update to reference standard(s) already in the ICC Code Books
Add new standard(s) as follows:
ASTM C1313/C1313M-13 Standard Specification for Sheet Radiant Barriers for Building Construction Applications.

Part II

2015 International Energy Conservation Code

R202 (N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

EMITTANCE.
The ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

RADIANT BARRIER.

A material having a low *emittance* surface of 0.1 or less installed in building assemblies.

Add new text as follows:

R303.1.5 (N1101.10.5) Radiant barrier. The emittance of *radiant barriers* shall be 0.1 or less. *Radiant barriers* shall comply with ASTM C1313/C1313M.

Reference standards type: This is an update to reference standard(s) already in the ICC Code Books

Add new standard(s) as follows:

ASTM C1313/C1313M-13 Standard Specification for Sheet Radiant Barriers for Building Construction Applications.

Reason: This proposal DOES NOT require the use of radiant barriers. But rather does require that WHEN radiant barriers are used, they comply with the appropriate ASTM standard. Furthermore this proposal provides important information to the code user and code enforcement community regarding radiant barriers.

The definition for "Radiant Barrier" was approved in the last cycle and is included in the 2015 IBC.

Radiant barriers follow two ASTM Standards – ASTM C1313/C1313M, "Standard Specification for Sheet Radiant Barriers for Building Construction Applications," and ASTM C1744, "Standard Practice for Installation and Use of Radiant Barrier Systems (RBS) in Commercial/Industrial Building Construction".

The proposed language is being included in this section specifically because the American Society for Testing and Materials (ASTM) classifies radiant barriers as thermal insulation. The ASTM committee C16 on Thermal Insulation includes published standards for this product. Subcommittee C16.21 deals specifically with reflective products, which include reflective insulation, radiant barrier and interior radiation control coatings. C16.21 develops standards and practices for these reflective building material thermal insulating products.

Radiant barrier products include a surface with an emittance of 0.1 or less that is installed in roof assemblies or attics with the low-emittance surface facing an open or ventilated air space.[1] The low emittance material can be bonded to plastic film, woven fabric, reinforced paper, OSB or plywood. The thermal performance of radiant barriers depends on emittance and location in the attic, wall or roof assembly. Radiant barriers are predominantly installed in attic spaces below the roof deck. The low-emittance surface of radiant barrier products dramatically reduces the heat gain by radiation into the structure and attic HVAC ducts. For this reason, radiant barriers are especially effective in warm sunny climates where they provide reduced use of air conditioning. Radiant barrier products that are available include single-sheet material, multi-layer assemblies and wood sheathing with attached aluminum film or foil. The single sheet material is installed in roof assemblies by attaching directly to the roof deck, in between the rafters or trusses or to the underside of the rafters or trusses. The foil-faced sheathing is installed with the low-emittance side of the sheathing or panel facing toward the attic space to create a radiant barrier.

Attic radiant barriers are in extensive use. These products have been on the market for several decades and are used by 87 of the top 100 US Builders. They have an established history and have been accepted into several regional code requirements. Over 800 million square feet of the product is being installed annually.

Many state and jurisdictional codes already include references on radiant barriers. These are the state and city codes that include radiant barriers:

- IBC 2015 – Section 1509, Radiant Barriers Installed Above Roof Deck
- HI – Chapter 181 of Title 3, 2015, Section 407.2, Table 407.1
- TX - Austin, Chapter 25-12-263, Article 12, 2013. Energy Code, Section 402.7
- FL – 2010 Florida Building Code, Section 405.6.1, Figure 405.6.1 & Table 303.2 (ASTM Standards C1313 & C1158)

- FL – 2015 Florida Building Code, Section 405.7.1, Figure 405.7.1 & Table 303.2.1 (ASTM Standards C1313 & C1158) & Performance Section 6.5.4.1
- CA – Title 24, 2013, Part 6, Subsection 8, Section (c), Subsection 2; Table 150.1-A; Reference Residential Appendix RA4

Bibliography: [1] 2014 Annual Book of ASTM Standards, ASTM C1313, ASTM, 2014, Vol 04.06 pp 758-761.

Cost Impact: Will not increase the cost of construction
This proposal w ill not increase the cost of construction because it only adds informational language regarding radiant barriers.

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM C1313M, w ith regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) w ill be posted on the ICC w ebsite on or before April 1, 2015.

CE28-16 : C303.1.1.2 (NEW)-HICKMAN12289

Text was cut off the published code change proposal. Replace the code change proposal with the following.

CE209-16

IECC: C405.4.2.2.1.

Proponent : Jeremiah Williams (jeremiah.williams@ee.doe.gov)

2015 International Energy Conservation Code

Revise as follows:

C405.4.2.2.1 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, power shall be determined in accordance with Equation 4-10.

~~Additional interior lighting power allowance = 500 watts + (Retail Area 1 • 0.6 W/ft (Retail Area 2 • 0.6 W/ft ^{2}) + (Retail Area 3 • 1.4 W/ft ^{2}) + (Retail Area 4 • 2.5 Wft ^{2})~~

Additional interior lighting power allowance = 300 W + (*Retail Area 1* • 0.36 W/ft ^{2}) + (*Retail Area 3* • 0.84 W/ft ^{2}) + (*Retail Area 4* • 1.87 W/ft ^{2})

For SI units:

Additional interior lighting power allowance = 300 W + (*Retail Area 1* • 3.87 W/m ^{2} + (*Retail Area 3* • 9.04 W/m ^{2}) + (*Retail Area 4* • 20.1 W/m ^{2})

(Equation 4-10)

where:

~~Retail Area 1~~ *Retail Area 1*	=	The floor area for all products not listed in Retail Area 2, 3 or 4.
~~Retail Area 2~~ *Retail Area 2*	=	The floor area used for the sale of vehicles, sporting goods and small electronics.
~~Retail Area 3~~ *Retail Area 3*	=	The floor area used for the sale of furniture, clothing, cosmetics and artwork.
~~Retail Area 4~~ *Retail Area 4*	=	The floor area used for the sale of jewelry, crystal and china.

Exception: Other merchandise categories are permitted to be included in Retail A that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

2. For spaces in which lighting is specified to be installed in addition to the general lighting for

   the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall be not more than 1.0 ~~w~~ W/ft^2 (10.7 ~~w~~ W/m^2) of such spaces.

Reason: The code allows additional lighting wattage for display lighting in retail areas to acknowledge the need for bright merchandise lighting. This proposal reduces that allowance based on providing equivalent lighting levels with newer light emitting diode (LED) lamp technology. A large portion of retail display lighting that is eligible for the additional allowances typically uses Halogen MR-16 lamps. The LED market has been working steadily to enter this area. In 2012, there were many effective products but they were not robust enough to replace the higher wattage (50W) MR-16 products. As of 2014 and beyond, this has changed. There are now many products covering the spread of the capabilities of the 20W to 50W Halogen MR-16s. LED offerings are effective direct replacements for retail display Halogen. Information from recent reports[1] shows that LED could provide similar light at approximately 30% of the existing Halogen wattage or a 70% reduction. A more conservative approach is taken in this proposal, with a 50% reduction in the general display allowance and a 25% reduction in retail area 4.

This proposal does not include any changes to the decorative lighting allowance in item 2, although the lower case w/ft^2 have been changed to upper case W/ft^2.

Energy Savings: While there is a high variation in how different retail establishments apply display lighting, an analysis of the DOE strip mall prototype[2] for the impact of the proposed savings shows annual energy cost savings of 2.7% per year or around $850 for a 22,500 square foot establishment. This electric cost savings is in addition to the lamp replacement cost savings from using longer life LEDs.

The U.S. Department of Energy (DOE) develops its proposals through a public process to ensure transparency, objectivity and consistency in DOE-proposed code changes. Energy savings and cost impacts are assessed based on established methods and reported for each proposal, as applicable. More information on the process utilized to develop the DOE proposals for the 2018 IECC can be found at: https://www.energycodes.gov/development/2018IECC.

Bibliography:

1. http://apps1.eere.energy.gov/buildings/publications/pdf s/ssl/snapshot2014_mr16.pdf & http://apps1.eere.energy.gov/buildings/publications/pdf s/ssl/caliper_22_summary.pdf .
2. The DOE prototypes represent typical U.S. building stock and the building energy use is simulated in EnergyPlus. See more information about the prototypes at: https://www .energycodes.gov/commercial- prototype-building-models.

Cost Impact: Will increase the cost of construction

The LED fixtures for use in display light fixtures provide more lighting output at a lower energy use. LEDs have a higher cost per lamp, but their expected life is longer, so their overall cost is lower. A survey of typical lamps in the 200 to 800 lumen output range is shown in the following table, based on a review of online lamp prices from a national maintenance product supplier.

MR-16 lamp	Lumen Output	Cost per lamp	Life, hours MTTF*	Lamp cost, $/3000 hours	$/500 lumens /3000 hours	$/500 lumens /3000 hours Limited to 5 year use

Halogen	200	$3.33	3,000	$3.33	$8.33	$8.33
Halogen	400	$3.08	1,971	$4.69	$5.86	$5.86
Halogen	500	$15.31	3,000	$15.31	$15.31	$15.31
Halogen	790	$6.47	3,000	$6.47	$4.09	$4.09
Average Halogen		**$7.05**		**$7.45**	**$8.40**	**$8.40**
LED	450	$16.25	25,000	$1.95	$2.17	$3.61
LED	370	$37.00	25,000	$4.44	$6.00	$10.00
LED	650	$35.00	30,000	$3.50	$2.69	$5.38
Average LED		**$23.82**		**$3.30**	**$3.62**	**$6.33**
Ratio of LED to Halogen lamp cost				44%	43%	75%

*MTTF is mean time to failure, a statistically calculated lamp life.

LED prices are expected to continue to decrease, and will be lower by the time this code is adopted. Lamp costs are normalized to 500 lumens of output and 3000 hours of operation a year or about 10 hours per day for 6 days a week. The last column in the table is the lamp cost per 500 lumens per 3000 hours, but limits the LEDs to 5 years of use at 3000 hours per year. In both the full life and conservative 5-year case, the average lamp cost for LEDs is less once lamp life is considered. The costs shown do not include additional lamp replacement labor savings or any reduction in electrical distribution costs due to lower wattage lamps. From several points of view, the use of LED fixtures for display lighting represents a reduction in life cycle lamp costs to building owners.

Cost-effectiveness: This change is cost-effective in that it provides significant savings with no anticipated life-cycle cost increase.

The following images are part of the reason statement.

CE272-16

Climate Zone	Representative City	High-Rise		Mid-Rise		Low-Rise	
		Ne. EUI Savings	Ne. ECI Savings	Net EUI Savings	Net ECI Savings	Ne. EUI Savings	Ne. ECI Savings
1A	Miami	0.0%	0.0%	0.0%	0.0%	1.6%	1.9%
1B	Riyadh	0.0%	0.0%	0.0%	0.0%	Zero Weights	Zero Weights
2A	Houston	0.0%	0.0%	0.0%	0.0%	1.3%	1.9%
2B	Phoenix	0.0%	0.0%	0.0%	0.0%	1.2%	2.8%
3A	Memphis	0.0%	0.0%	0.0%	0.0%	2.1%	1.3%
3B	El_paso	0.0%	0.0%	0.0%	0.0%	1.9%	3.1%
3C	San_Francisco	0.0%	0.0%	0.0%	0.0%	1.9%	2.4%
4A	Baltimore	0.0%	0.0%	0.0%	0.0%	2.1%	2.8%
4B	Albuquerque	0.0%	0.0%	0.0%	0.0%	2.1%	2.7%
4C	Salem	0.0%	0.0%	0.0%	0.0%	2.1%	3.2%
5A	Chicago	0.0%	0.0%	0.0%	0.0%	2.2%	3.7%
5B	Boise	0.0%	0.0%	0.0%	0.0%	2.2%	4.1%
5C	Vancouver	0.0%	0.0%	0.0%	0.0%	Zero Weights	Zero Weights
6A	Burlington	0.0%	0.0%	0.0%	0.0%	2.2%	3.8%
6B	Helena	0.0%	0.0%	0.0%	0.0%	2.2%	4.1%
7	Duluth	0.0%	0.0%	0.0%	0.0%	2.4%	4.2%
8	Fairbanks	0.0%	0.0%	0.0%	0.0%	Zero Weights	Zero Weights
	Weighted Average	0.0%	0.0%	0.0%	0.0%	2.3%	2.9%

Climate Zone	Representative City	10-Story High-Rise	4-Story Mid-Rise	3-Story Mid-Rise	2-Story Mid-Rise
		EUI Savings	EUI Savings	EUI Savings	EUI Savings
1A	Miami	-3.0%	-4.3%	5.0%	0.0%
1B	Riyadh	2.8%	4.2%	4.7%	Zero Weights
2A	Houston	-3.5%	-4.0%	5.3%	0.0%
2B	Phoenix	-3.4%	-4.9%	5.5%	0.2%
3A	Memphis	-1.9%	-2.8%	3.2%	-3.3%
3B	El_paso	-2.6%	-3.5%	4.0%	-2.9%
3C	San_Francisco	-3.0%	-3.9%	4.8%	-3.2%
4A	Baltimore	-1.9%	-2.4%	3.1%	-2.5%
4B	Albuquerque	2.2%	3.1%	3.5%	2.7%
4C	Salem	-2.3%	-2.9%	3.3%	-1.2%
5A	Chicago	-1.7%	-2.0%	2.4%	-2.1%
5B	Boise	2.1%	2.7%	3.3%	1.5%
5C	Vancouver	-2.0%	-2.5%	3.2%	Zero Weights
6A	Burlington	-0.4%	-0.6%	1.3%	-1.3%
6B	Helena	-0.8%	-1.0%	1.5%	-1.2%
7	Duluth	-0.8%	-1.3%	1.8%	-2.2%
8	Fairbanks	-1.3%	-2.0%	2.4%	Zero Weights
	Weighted Average	2.3%	2.7%	3.3%	2.3%

Climate Zone	Representative City	10-Story High-Rise		4-Story Mid-Rise		3-Story Mid-Rise	
		EUI Savings (low [illegible])	EUI Savings (high [illegible])	EUI Savings (low [illegible])	EUI Savings (high [illegible])	EUI Savings (low [illegible])	EUI Savings (high [illegible])
1A	Miami	-3.7%	-4.2%	-1.0%	-1.0%	1.0%	1.0%
1B	Riyadh	-5.1%	-6.0%	-1.3%	-1.5%	Zero Weights	Zero Weights
2A	Houston	2.3%	2.7%	0.3%	0.2%	1.0%	1.0%
2B	Phoenix	-3.5%	-4.3%	-1.0%	-1.5%	1.0%	1.0%
3A	Memphis	-2.8%	-3.8%	-0.6%	-0.8%	0.5%	0.5%
3B	El_paso	-1.0%	-1.0%	-0.3%	-0.8%	0.0%	0.0%
3C	San_Francisco	0.0%	1.2%	0.0%	0.0%	1.2%	0.0%
4A	Baltimore	2.9%	3.8%	0.5%	0.8%	1.0%	0.0%
4B	Albuquerque	-1.0%	-1.0%	0.0%	0.0%	1.0%	1.0%
4C	Salem	1.3%	2.1%	0.0%	0.0%	1.1%	0.0%
5A	Chicago	3.7%	4.6%	0.8%	0.8%	1.2%	1.0%
5B	Boise	-1.0%	-1.5%	0.0%	0.0%	0.0%	0.0%
5C	Vancouver	1.1%	2.1%	0.3%	0.2%	Zero Weights	Zero Weights
6A	Burlington	3.5%	4.7%	0.0%	0.8%	1.0%	1.0%
6B	Helena	-1.4%	-2.5%	-0.4%	-1.0%	1.0%	1.0%
7	Duluth	-4.8%	-6.4%	-0.7%	-1.5%	1.3%	0.9%
8	Fairbanks	2.4%	2.4%	0.0%	0.7%	Zero Weights	Zero Weights
	Weighted Average	-2.8%	-3.7%	-0.3%	-0.8%	1.0%	1.0%

See highlighted text for changes.

TENTATIVE ORDER OF DISCUSSION
2016 PROPOSED CHANGES TO THE INTERNATIONAL ENERGY CONSERVATION CODE – RESIDENTIAL AND INTERNATIONAL RESIDENTIAL CODE - ENERGY

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

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

<u>NUMBERS NOT USED</u>

RE62-16
RE88-16
RE93-16

-
  - ADM1-16 Part III
  - CE2-16 Part II
- RE3-16
  - CE1-16 Part II
  - CE3-16 Part II
  - ADM2-16 Part III
  - ADM6-16 Part III
  - ADM4-16 Part III
  - CE4-16 Part II
  - CE5-16 Part II
  - ADM9-16 Part III
  - CE7-16 Part II
  - CE272-16 Part II
  - CE8-16 Part II
  - CE11-16 Part II
  - ~~G9-16 Part II~~
- RE4-16
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- RE6-16
  - CE13-16 Part II
  - ADM16-16 Part III
  - CE14-16 Part II
- RE7-16
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  - CE18-16 Part II
  - ADM26-16 Part III
  - ADM35-16 Part III
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CE26-16 Part II
CE27-16 Part II
CE33-16 Part II
CE31-16 Part II
CE30-16 Part II
RE190-16
CE28-16 Part II
CE25-16 Part II
CE24-16 Part II
CE29-16 Part II
CE10-16 Part II
RE10-16
RB373-16

Table revisions were incorrect. Replace the proposal with the following.

RE146-16

Table R405.5.2(1) [IRC Table N1105.5.2(1)]

Proponent : Tom Kositzky, Coalition for Fair Energy Codes, representing Coalition for Fair Energy Codes; Mark Halverson, representing APA (mark.halverson@apawood.org); Loren Ross, representing TBD (LRoss@awc.org)

2015 International Energy Conservation Code

TABLE R405.5.2(1) [N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of Table not shown remain unchanged

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame.	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table N1102.1.4	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed
Basement and crawl space walls	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table N1102.1.4, with insulation layer on interior side of walls	As proposed
Above-grade floors	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table N1102.1.4	As proposed
Ceilings	Type: wood frame	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table N1102.1.4	As proposed
Roofs	Type: composition shingle on wood sheathing	As proposed
	Gross area: same as proposed	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed

Attics	Type: vented with aperture = 1 ft^2 per 300 ft^2 ceiling area	As proposed
Foundations	Type: same as proposed	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed	As proposed
Opaque doors	Area: 40 ft^2	As proposed
	Orientation: North	As proposed
	U-factor: same as fenestration from Table N1102.1.4	As proposed
Vertical fenestration other than opaque doors	Total area[h] = ~~(a)The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area~~ ~~(b)~~15 percent of the conditioned floor area~~, where the proposed glazing area is 15 percent or more of the conditioned floor area~~	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table N1102.1.4	As proposed
	SHGC: as specified in Table N1102.1.2 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design)	0.92-(0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	Air leakage rate of 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8 at a	

Air exchange rate	pressure of 0.2 inches w.g (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 × *CFA* + 7.5 ×(N_{br} + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, the same air leakage rate as the standard reference design. For tested residences, the measured air exchange rate[a] . The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.

For SI: 1 square foot = 0.93 m^2 , 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2 , 1 gallon (US) = 3.785 L, Â°C = (Â°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official* , testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals* , or the equivalent shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals* , page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals* , page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

~~h. For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine glazing area:~~

~~$AF = A_S \times FA \times F$~~

~~where:~~

~~AF = Total glazing area.~~

~~A_S = Standard reference design total glazing area.~~

~~FA = (Above-grade thermal boundary gross wall area)/above-grade boundary wall area + .0.5 x below-grade boundary wall area).~~

~~F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.~~

~~and where:~~

~~Thermal Boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.~~

~~Below-grade boundary wall is any thermal boundary wall in soil contact.~~

~~Common wall area is the area of walls shared with an adjoining dwelling unit.~~

~~L and CFA are in the same units.~~

Reason: While typically only 15% of the floor area, fenestrations account for over 50% of the UA of envelope walls, so even small changes in fenestration area result in large changes in wall energy efficiency. It is only logical that the code recognize the savings from smaller glazing area via the performance path.

Currently, providing glazing area greater than 15% of the floor area is penalized for its reduced energy efficiency. This makes sense; more use of less efficient wall components creates a penalty.

However, reducing glazing area to less than 15% of the floor area is not rewarded for increasing energy efficiency. This does not make sense; increased use of more efficient wall components should be rewarded.

The thermal performance of code-conforming windows is not comparable to opaque walls. In the 2015 IECC-R, walls are typically 6 times more energy efficient than windows. The least insulated opaque walls (Climate Zone 1) are more than 4 times more efficient than the windows required in the coldest climate zone (Climate Zone 8).

Comparison Of U Factor Requirements[a] For Glazing Versus Opaque Walls In The 2015 IECC-R

Climate Zone	1	2	3	4	5	6	7	8
Fenestration (Glazing)	.50	0.40	0.35	0.35	0.32	0.32	0.32	0.32
Frame wall (Opaque walls)	.084	.084	.060	.060	.060	.045	.045	.045
How much more efficient opaque frame wall area is compared to glazed area (rounded to whole number)	**6X**	**5X**	**6X**	**6X**	**5X**	**7X**	**7X**	**7X**

a. Table R402.1.4 Equivalent U-factors

Even with the current proposals to lower the window U-factors, there is no indication that window U-factors will approach the U-factors of opaque walls in the near term.

The IECC must recognize and encourage the option of less glazed area as a core principle of energy efficient buildings.

Cost Impact: Will not increase the cost of construction
This proposal makes modifications to Table R405.5.2(1) which establishes criteria for how proposed residential designs will be analyzed to determine energy efficiency. The proposal does not increase or change the standard reference glazing area of 15% of conditioned floor area. If it did, it could result in higher construction costs. Instead it merely recognizes that a proposed glazing area that is less than 15% of conditioned floor area, results in additional energy savings. This is in keeping with a true performance path approach and as such will not increase the cost of construction.

RE146-16 : TABLE R405.5.2-KOSITZKY12442

Replace the code change proposal with the following.

EB58-16

APPENDIX A, Chapter A1, Chapter A6

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 Callifornia (dojala@exponent.com)

THIS CODE CHANGE WILL BE HEARD BY THE IBC-STRUCTURAL CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THIS COMMITTEES.

2015 International Existing Building Code

APPENDIX A Guidelines for the Seismic Retrofit of Existing Buildings
CHAPTER PART A1—SEISMIC STRENGTHENING PROVISIONFOR 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} 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} m^2).

A_n = Area of net mortared or grouted section of a wall or wall pier

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

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

Height-to-thickness ratio of URM wall.

h/t	=	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 (m).
L_c	=	Length of crosswall, feet (m).
L_i	=	Effective diaphragm span for an open-front building specified in Section A111.8, feet (m).
P	=	Applied force as determined by standard test method of ASTM C 496 or ASTM E 519, pounds (N).
P_D	=	Superimposed dead load at the location under consideration, pounds (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 (kPa).
P_{test}	=	Splitting tensile test load determined by standard test method ASTM C496, pounds (N)
P_W	=	Weight of wall, pounds (N).
R	=	Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where R = 1.5.
~~S_{DS}~~	~~=~~	~~Design spectral acceleration at short period, in g units.~~
~~S_{D1}~~ S_{DS}	=	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 (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 (N/m).

v_m	=	Shear strength of unreinforced masonry, pounds per square inch (kPa).
V_{aa}	=	The shear strength of any URM pier or wall, pounds (N).
V_{ca}	=	Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, $v_C L_C$, pounds (N).
V_{cb} $_{ca}$	=	Total shear capacity of crosswalls in the direction of analysis immediately below above the diaphragm level being investigated, $v_C L_C$, pounds (N).
V_{cb}	=	Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, $v_C L_C$, pounds (N).
V_p	=	Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).
V_r	=	Pier rocking shear capacity of any URM wall or wall pier, pounds (N).
v_t	=	Mortar shear strength as specified in Section A106.3.3.5, pounds per square inch (kPa).
V_{test}	=	Load at incipient cracking for each in-place shear test performed in accordance with Section A106.3.3.1, pounds (kN).
v_{to} $_t$	=	Mortar (bed joint) shear test values strength as specified in Section A106.3.3.5, pounds per square inch (kPa).
V_{test}	=	Load at incipient cracking for each in-place shear test performed in accordance with Section A106.3.3.1, pounds (kN).
V_{tL}	=	Lower bound mortar shear strength, pounds per square inch (kPa)
v_{to}	=	Mortar shear test values as specified in Section A106.3.3.5, pounds per square inch (kPa).
v_u	=	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).

V_{wx} = Total shear force resisted by a shear wall at the level under consideration, pounds (N).

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

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

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

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

$\Sigma v_u D$ = Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).

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

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

SECTION A105 GENERAL REQUIREMENTS

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

[BS] 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~~ <u>URM walls,</u> new crosswalls and shear walls<u>,</u> 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<u> URM</u> 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 joints, and if and where pointing is required. Where the exterior face is veneer, the type of veneer, its thickness and its bonding and/or ties to the structural wall masonry shall also be noted.
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 forceresisting 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 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.

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~~ A106.2.2.1 ~~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 ~~fulllength headers~~ header courses shall not exceed 24 inches (610 mm) vertically or horizontally. Wher~~e 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~~ , and 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 bricks 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 *Vtest* 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).~~

Mortar shear test values, v_{to}, shall be obtained by one of the following:

1. ASTM C1531.

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.

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''_m, ~~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:~~

$$f_{sp} = \frac{2P}{\pi a_n}$$

$$f_{sp} = \frac{2P_{test}}{\pi a_n}$$ **(Equation A1-1)**

~~2. Hollow unit masonry constructed of through-thewall 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 should be placed in a vertical position. The tensile-splitting strength should be determined by the following equation:~~

$$f_{sp} = \frac{0.494P}{a_n}$$ ~~**(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.~~

[BS] ~~A106.3.3.3~~ A106.2.3.3 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~~ 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~~ Results 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] ~~A106.3.3.4~~ A106.2.3.4 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] ~~A106.3.3.5~~ A106.2.3.5 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:

$$v_{to} = (V_{test}/A_b) - P_{D+L}$$ **(Equation A1-~~3~~ 2)**

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_{to}~~consistently~~ less than 30 pounds per square inch (207 kPa) shall be ~~entirely~~ pointed prior to and retested ~~retesting~~.
3. The lower-bound mortar shear strength, v_{tL}, is ~~the value in pounds per square inch (kPa) that is exceeded by 80 percent~~ defined as he mean minus one standard deviation of the mortar shear test values,v_{to}.
4. Unreinforced masonry with mortar shear strength, v_{tL} 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] ~~A106.3.3.6~~ A106.2.3.6 Minimum quality of masonry.

1. The minimum average value of tensile-splitting strength~~ determined~~ , f_{sp}, as calculated 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~~ and retested.
3. ~~Hollow unit unreinforced masonry walls with estimated prism compressive~~ The lower-bound mortar shear strength, f_{spL}, is defined as the mean minus one standard deviation of the tensile-splitting strength ~~of less than 1,000 pounds per square inch (6895 kPa) shall be grouted to increase the average net area compressive strength~~ test values, f_{sp}.

[BS] ~~A106.3.3.7~~ A106.2.3.7 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] ~~A106.3.3.8~~ 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~~ strength determined in accordance with Section A108.2. Classes ~~shall be~~ are 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] ~~A106.3.3.9~~ 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~~ Deteriorated mortar shall be cut out by means of a toothing chisel or non- impact power tool ~~to a depth at which~~ until sound mortar is reached but to a depth of not less than $^3/_4$ 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~~ 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~~ prepared by first thoroughly mixing all ingredients dry and then mixing again, adding only enough water to produce a damp ~~workable~~ unworkable mix ~~which will retain~~ 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 $1^{1}/_{2}$ hours for pre-hydration; then sufficient water shall be added to bring it to a workable consistency ~~that~~ 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 ~~damp~~ dampened but without freestanding water. The mortar shall be tightly packed into the joint in layers not exceeding $^{1}/_{4}$ 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 ~~A106.3.3~~ 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~~ A 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 joist 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 $^1/_8$ 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:

$^1/_2$ -inch-diameter (12.7 mm) bolts: 40 foot pounds (54.2 N-m).

$^5/_8$ -inch-diameter (15.9 mm) bolts: 50 foot pounds (67.8 N-m).

$^3/_4$-inch-diameter (19.1 mm) bolts: 60 foot pounds (81.3 N-m).

[BS] A107.5.3 Prequalification ~~test~~ 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 $^1/_8$ inch (3.2 mm) elongation occurs for each size and type of ~~bolt~~ anchor and class of masonry.

~~The test procedure for prequalification of shear bolts shall comply with ASTM E 488 or another approved procedure.~~

~~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~~ The strength reduction ~~factors need not~~ factor, Φ , shall be ~~used~~ taken equal to 1.0.
3. The use of ~~new~~ materials not specified herein shall be ~~based on substantiating research data or engineering judgment, with~~ subjected to the discretion and approval of the ~~building official~~ 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~~ When testing is performed in accordance with section A106.2.3.1, the unreinforced masonry shear strength, ~~v_m~~ v_{mL}, shall be determined by Equation ~~A1-4 when the mortar shear strength has been determined by Section A106.3.3.1.~~ A1-3:

$$v_{mL} = \frac{0.75\left(0.75 v_{tL} + \frac{P_D}{A_n}\right)}{1.5} \qquad \text{~~}v_m = 0.56 v_t + \frac{0.75 P_D}{A}\text{~~}$$

(Equation ~~A1-4~~ A1-3)

The mortar shear strength values, ~~v_t~~ v_{tL}, shall be determined in accordance with Section ~~A106.3.3~~ A106.2.3.5.

2. ~~The~~ When alternate testing is performed in accordance with Section A106.2.3.2, unreinforced masonry shear, ~~v_m~~ v_{mL}, shall be determined by Equation ~~A1-5 when tensile-splitting strength has been determined in accordance with Section A 106.3.3.2, Item 1 or 2~~ A1-4.

$$\text{c)} \quad v + 0.75\frac{P_D}{A}$$

(Equation ~~A1-5~~ A1-4)

3. ~~When f'_m 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) 2.5~~

$$v_{mL} = \frac{0.75\left(f_{spt} + \frac{P_D}{A_n}\right)}{1.5}$$

~~or b) 200 psi or~~

c) $v + 0.75\frac{P_D}{A}$ ~~(Equation A1-6)~~

~~For SI: 1 psi = 6.895 kPa.where:~~

~~v = 62.5 psi (430 kPa) for running bond masonry not grouted solid.~~

~~v = 100 psi (690 kPa) for running bond masonry grouted solid.~~

~~v = 25 psi (170 kPa) for stack bond grouted solid~~

[BS] A108.3 Masonry compression. Where any increase in wall dead plus live load compression stress occurs, the maximum compression stress in unreinforced masonry, Q_G/A_n, shall not exceed 300 pounds per square inch (2070 kPa).

[BS] A108.4 Masonry tension. Unreinforced masonry shall be assumed to have no tensile capacity.

[BS] A108.5 ~~Existing~~ Wall tension anchors. The ~~resistance values~~ tension strength of ~~the existing~~ wall anchors shall be the average of the tension ~~tests of existing~~ test values for anchors having the same wall thickness and ~~joist~~ framing orientation.

[BS] A108.6 Foundations. For existing foundations, new total dead loads ~~may~~ are permitted to 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

[BS] A109.1 General. The elements of buildings hereby required to be analyzed are specified in Table A1-A.

[BS] A109.2 Selection of procedure. 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~~ 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.

SECTION A110 GENERAL PROCEDURE

[BS] A110.1 Minimum design lateral forces. 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:

$$V = \frac{0.75 S_{DS} W}{R}$$ **(Equation ~~A1-7~~ A1-5)**

[BS] A110.2 ~~Lateral~~ Seismic forces on elements of structures. 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-tothickness~~ 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.

[BS] A110.3 In-plane loading of URM shear walls and frames. Vertical ~~lateral load-resisting~~ seismic force-resisting elements shall be analyzed in accordance with Section A112.

[BS] A110.4 Redundancy and overstrength factors. 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_V) may be taken as zero.

SECTION A111 SPECIAL PROCEDURE

[BS] A111.1 Limits for the application of this procedure. 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 masonry and concrete shear walls.
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~~ open-front 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 (12 192 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 $0.5S_{D1}\Sigma W_d$ 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:

$$DCR = \frac{(2.1S_{D1}W_d + V_{ca})}{2v_uD}$$

(Equation A1-8) **(Equation ~~A1-8~~ A1-6)**

$$DCR = \frac{(2.1S_{D1}W_d + V_{ca})}{2v_uD}$$

[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:

   $DCR = 2.1S_{D1}W_d/\Sigma v_uD$ **(Equation ~~A1-9~~ 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:

   $DCR = 2.1S_{D1}W_d/\Sigma v_uD + V_{cb}$ **(Equation ~~A1-10~~ A1-8)**

3. For diaphragms in a multistory building with qualifying crosswalls in all levels:

   $DCR = 2.1S_{D1}\Sigma W_d/(\Sigma\Sigma v_uD + V_{cb})$ **(Equation ~~A1-11~~ 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:

   $DCR = 2.1\,S_{D1}\,\Sigma W_d/\Sigma\Sigma v_uD$ **(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:

$V = 1.2\,S_{D1}C_pW_d$ **(Equation ~~A1-13~~ A1-11)**

using the C_p values in Table A1-C, or

$V = v_uD$ **(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:

$F_{wx} = 0.8\,S_{D1}\,(W_{wx} + W_d/2)$ **(Equation ~~A1-15~~ A1-13)** but need not exceed

$F_{WX} = 0.8\ S_{D1}(W_{WX} + v_u D)$ **(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.

$V_{WX} = \Sigma\ F_{WX}$ **(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~~ 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:

   $L_i = 2[(\ W_w / W_d\ )\ L + L\ ]$ **(Equation ~~A1-18~~ A1-16)**

2. Diaphragm demand-capacity ratio shall be calculated as:

   $DCR = 2.1\ S_{D1}(W_d + W_w)/[(v_u D) + V_{cb}]$ **(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~~.~~

[BS] A112.2.1 Flexural rigidity. Flexural components of deflection may be neglected in determining the rigidity of an unreinforced masonry wall.

[BS] A112.2.2 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:

   $V_a = v_m A_n$~~/1.5~~ **(Equation ~~A1-20~~ A1-18)**

   Where A_n=area of net mortared or grouted section of a wall or wall pier

   1.2. The pier rocking shear capacity shall be calculated as:

   $V_r = 0.9\ P_D D/H$ **(Equation ~~A1-21~~ 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 $P_D D/H$. For the wall at that level:

$0.7V_{wx} < \Phi V_r$ **(Equation ~~A1-22~~ A1-20)**

2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity, i.e., $V_a r$ 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:

$V_p < V_a$ **(Equation ~~A1-23~~ A1-21)**

and

$V_p < V_r$ **(Equation ~~A1-24~~ A1-22)**

If V_p ~~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_r shall be calculated as follows:

$V_r = 0.9(P_D + 0.5 P_W) D/H$ **(Equation ~~A1-25~~ A1-23)**

[BS] A112.3 Plywood-sheathed shear walls. ~~Plywoodsheathed~~ 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. ~~Momentresisting~~ 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~~ resist 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 $0.9S_{DS}$ 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. ~~Bolts~~ 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-tothickness~~ 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~~ is permitted to be 6 inches (152 mm).

TABLE ~~0~~ A1-B
ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS

WALL TYPES	$0.13g \le S_{D1}g$	$0.25g \le S_{D1}g$	$S_{D1} \ge 0.4g$ BUILDINGS WITH CROSSWALLS[a]	S_{D1} ~~>~~ $\ge 0.4g$ ALL OTHER BUILDINGS
Walls of one-story buildings	20	16	16[b,c]	13
First-story wall of multistory building	20	18	16	15
Walls in top story of	14	14		9

multistory building			14[b,c]	
All other walls	20	16	16	13

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, v_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, v_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.

TABLE ~~0~~ A1-E
STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION

NEW MATERIALS OR CONFIGURATION OF MATERIALS		STRENGTH VALUES
Horizontal diaphragms	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.	675 lbs. per ft.
Crosswalls	Plywood sheathing applied directly over wood studs; no value should be given to plywood applied over existing plaster or wood sheathing.	1.2 times the value specified in the current building code.
	Drywall or plaster applied directly over wood studs.	The value specified in the current building code.
	Drywall or plaster applied to sheathing over	50 percent of the

	existing wood studs.	value specified in the current building code.
Tension ~~bolts~~[e] anchors[f]	~~Bolts~~Anchors 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.[b,c]	5,400 lbs. per ~~bolt~~anchor for three wythe minimum walls. 2,700 lbs. for two-wythe walls.
Shear ~~bolts~~[e] anchors[f]	~~Bolts~~Anchors embedded a minimum of 8 inches into unreinforced masonry walls; ~~bolts~~ anchors should be centered in 2 1/2 -inch-diameter holes with dry- pack or nonshrink grout around the circumference of the ~~bolt~~ anchor.	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~~ anchors should be used.
Combined tension and shear ~~bolts~~anchors[f]	Through-~~bolts~~anchors—~~bolts~~anchors meeting the requirements for shear and for tension ~~bolts~~anchors.[b,c]	Tension—same as for tension ~~bolts~~anchors. Shear—same as for shear ~~bolts~~anchors.
	Embedded ~~bolts~~anchors—~~bolts~~anchorsextending to the exterior face of the wall with a 21/2 -inch round plate under the head and drilled at an angle of 221/2 degrees to the horizontal; installed as specified for shear ~~bolts~~anchors.[a,b,c]	Tension—3,600 lbs. per ~~bolt~~anchor. Shear—same as for shear ~~bolts~~anchors.

Infilled walls	Reinforced masonry infilled openings in existing unreinforced masonry walls; provide keys or dowels to match reinforcing.	Same as values specified for unreinforced masonry walls.
Reinforced masonry[d]	Masonry piers and walls reinforced per the current building code.	The value specified in the current building code for strength design.
Reinforced concrete[d]	Concrete footings, walls and piers reinforced as specified in the current building code.	The value specified in the current building code for strength design.

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm ^{2} , 1 pound = 4.4 N.

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

b. ~~Bolts to~~ Anchors shall be $^1/_2$ inch minimum in diameter.

c. Drilling for ~~bolts and dowels~~ 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 Exisiting 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.

ABK-84, *Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings: The Methodology*. Topical Report 08, National Science Foundation, Contract No. NSF-C-PFR78-19200. Washington, DC: Applied Science and Research Applications, 1984.

ABK-86, Guidelines for the Evaluation of Historic Brick Masonry Buildings in Earthquake Hazard Zones. ABK, A Joint Venture, Funded by the Department of Parks and Recreation of the State of California and the National Park Service, United States Government, January 1986.

ATC-78, *Tentative Provisions for the Development of Seismic Regulations for Buildings*, Report ATC 3-16. Redw ood City, CA: Applied Technology Council, 1978.

ATC-87, *Evaluating the Seismic Resistance of Existing Buildings*, Report ATC-14. Redw ood City, CA: Applied Technology Council, 1987.

ICBO-1988 through 1997, *Uniform Code for Building Conservation*. Whittier, CA: International Conference of Building Officials, 1988-1997.

ICBO-01, *Guidelines for the Seismic Retrofit of Existing, Buildings*. Whittier, CA: International Conference of Building Officials, 2006.

Preservation Brief 2, *Repointing Mortar Joints in Historic Masonry Buildings*. Robert C. Mack, FAIA, and John P. Spew eik for the National Park Service, United States Government, October 1998.

TN 46, *Technical Note on Maintenance of Brick Masonry*, pp. 3-5, *Mortar Joint Repair*. Reston, VA: The Brick Industry Association, December 2005.

Getty 2003. *Planning and Engineering Guidelines for the Seismic Retrofitting of Historic Adobe Structure*s.

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 w all, based on w hether w all reinforcement meets the building code requirements for reinforced masonry w alls, w ill have a cost impact. As a minimum, lightly reinforced masonry w alls need to be evaluated by a design professional in meeting the minimum life-safety and performance objectives intended in the building code. This w ill increase the cost to engage a design professional, but w ill 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, w ith regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) w ill be posted on the ICC w ebsite 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.

Replace the code change proposal with the following.

F198-16

IFC: 907.2.2 (IBC: [F] 907.2.2), 907.2.2.1 ([F] 907.2.2.1), K102.4 (New)

Proponent : John Williams, CBO, representing Adhoc Healthcare Committee (AHC@iccsafe.org)

2015 International Fire Code

Revise as follows:

907.2.2 Group B. A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B *occupant load* of all floors is 500 or more.
2. The Group B *occupant load* is more than 100 persons above or below the lowest *level of exit discharge*.
3. ~~The *fire area* contains an ambulatory care facility.~~

    Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

907.2.2.1 Ambulatory care facilities. Fire areas containing ambulatory care facilities shall be provided with a manual fire alarm system. *Fire areas* containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public *corridors* and elevator lobbies.

Exception: Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 provided the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

Add new text as follows:

K102.4 Manual fire alarm system. Fire areas containing an ambulatory care facility shall have a manual fire alarm system installed throughout the fire area.

Reason: The AHC is proposing a revision to address some of the oversights in the I-Codes of long-standing and operational requirements for hospitals and healthcare facilities that has not been specifically addressed. The requirements being proposed in this code change have been long-standing provisions of the construction and operational requirements for healthcare facilities.
In the last code cycle, the requirement for a manual fire alarm system was correlated with the IBC for consistency with CMS requirements for ambulatory healthcare facilities and was passed. Although Ambulatory Healthcare Facilities may be classified as a B-Business Occupancy, the intent was not to allow an exception for an Ambulatory Healthcare Facility's provision of a manual fire alarm system when the occupant load is under 100 persons. Since there have been questions presented to staff and the ICC Adhoc Healthcare Committee, we are proposing this reorganization to IFC/IBC Section 907.2.2 to provide additional clarification for the specific requirements for Ambulatory Healthcare Facilities. IBC Section 907.2.2.1 is the new subsection with the same requirements provided for under the previous code; it is being proposed to clearly identify where manual fire alarms are required and when any exception to this requirement would be applicable to the Ambulatory Healthcare Facility.

This proposal is submitted by the ICC Ad Hoc Committee on Healthcare (AHC). The AHC was established by the ICC Board to evaluate and assess contemporary code issues relating to hospitals and ambulatory healthcare facilities. This is a joint effort between ICC and the American Society for Healthcare Engineering (ASHE), a subsidiary of the American Hospital Association, to eliminate duplication and conflicts in healthcare regulation. In 2014 and 2015 the ICC Ad Hoc Committee has held 4 open meetings and numerous Work Group meetings and conference calls for the current code development cycle which included members of the committees as well as any interested party to discuss and debate the proposed changes. Information on the AHC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the AHC effort can be downloaded from the AHC website at: AHC.

Cost Impact: Will not increase the cost of construction
This is already a requirement in the code and the intent was never to have the ambulatory healthcare facility utilize the exception for an occupant load of less than one hundred persons.

F198-16 : 907.2.2-WILLIAMS12012

Replace the code change proposal with the following:

RB157-16

IRC: R301.2.4, R301.2.4.1, R322.1, R322.1.1, R322.3, R322.3.1, R322.3.2, R322.3.3, R322.3.4, R322.3.5, R322.3.5.1, R322.3.6, R322.3.7.

Proponent : Gregory Wilson (gregory.wilson2@fema.dhs.gov); Rebecca Quinn, representing Federal Emergency Management Agency (rcquinn@earthlink.net)

2015 International Residential Code

Revise as follows:

R301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2(1), and substantial improvement and restoration of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with Section R322. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways , coastal high hazard areas, and Coastal A Zones shall be designed and constructed in accordance with ASCE 24.

R301.2.4.1 Alternative provisions. As an alternative to the requirements in Section ~~R322~~ R322.2, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas, including A or V Zones and Coastal A Zones, as established in Table R301.2(1), and substantial improvement and restoration of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions contained in this section. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways , coastal high hazard areas, and Coastal A Zones shall be designed and constructed in accordance with ASCE 24.

R322.1.1 Alternative provisions. As an alternative to the requirements in Section ~~R322~~ R322.2, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R322.3 Coastal high-hazard areas (including V Zones and Coastal A Zones, where designated). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. Flood hazard areas that have been designated as subject to wave heights between 1$^{1}/_{2}$ feet (457 mm) and 3 feet (914 mm) or otherwise designated by the jurisdiction shall be designated as Coastal A Zones. Buildings and structures constructed in whole or in part in coastal high-hazard areas and coastal A Zones, where designated, shall be designed and constructed in accordance with ~~Sections R322.3.1 through R322.3.7~~ the applicable requirements of R322.1, ASCE 24, and this section.

Delete without substitution:

~~**R322.3.1 Location and site preparation.**~~ -

1. ~~New buildings and buildings that are determined to be substantially improved pursuant to Section R105.3.1.1 shall be located landward of the reach of mean high tide.~~
2. ~~For any alteration of sand dunes and mangrove stands, the *building official* shall~~

~~require submission of an engineering analysis that demonstrates that the proposed *alteration* will not increase the potential for flood damage.~~

~~**R322.3.2 Elevation requirements.**~~

1. ~~Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.~~
2. ~~Basement floors that are below *grade* on all sides are prohibited.~~
3. ~~The use of fill for structural support is prohibited.~~
4. ~~Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.~~
5. ~~Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.~~

~~**R322.3.3 Foundations.** Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.4. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section R322.3.6. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24. Slabs, pools, pool decks and walkways shall be located and constructed to be structurally independent of buildings and structures and their foundations to prevent transfer of flood loads to the buildings and structures during conditions of flooding, scour or erosion from wave-velocity flow conditions, unless the buildings and structures and their foundations are designed to resist the additional flood load.~~

> ~~**Exception:** In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.~~

~~**R322.3.4 Walls below design flood elevation.** Walls and partitions are permitted below the elevated floor, provided that such walls and partitions are not part of the structural support of the building or structure and:~~

1. ~~Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and~~
2. ~~Are constructed with insect screening or open lattice; or~~
3. ~~Are designed to break away or collapse without causing collapse, displacement or~~

~~other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or~~

~~4.~~ ~~Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a registered *design professional* that:~~

~~4.1.~~ ~~The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the base flood.~~

~~4.2.~~ ~~The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.~~

~~5.~~ ~~Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.~~

~~**R322.3.5 Enclosed areas below design flood elevation.** Enclosed areas below the design flood elevation shall be used solely for parking of vehicles, building access or storage.~~

~~**R322.3.5.1 Protection of building envelope.** An exterior door that meets the requirements of Section R609 shall be installed at the top of stairs that provide access to the building and that are enclosed with walls designed to break away in accordance with Section R322.3.4.~~

Revise as follows:

R322.3.6 Construction documents. The *construction documents* shall include documentation that is prepared and sealed by a registered *design professional* that the design and methods of construction to be used meet the applicable criteria of ~~this section~~ ASCE 24.

R322.3.7 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in ~~Section R322.3.2~~ ASCE 24. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of ~~Section R322.3~~ ASCE 24.

Reason: The IRC Section R322.3.6 requires documentation signed and sealed by registered design professionals that dwellings in coastal high hazard areas (Zone V) and Coastal A Zones (if the Limit of Moderate Wave Action is delineated on the Flood Insurance Rate Map or otherwise designed by the community) meet the applicable criteria. ASCE 24 Flood Resistant Design and Construction is the standard of practice for construction in flood hazard areas. ASCE 24 already is a referenced standard in the IRC: Section R301.2.4.1 and R322.1.1 permit use of ASCE 24 as an alterative to the prescriptive provisions of R322, and Section R322.3.3 requires spread footings, mats, rafts, or other foundation sthat support columns to be designed in accordance with ASCE 24.

The IRC requires engineering design or prescriptive engineering-based referenced standards for other high-hazard areas such as some high wind regions and areas where seismic design category E is identified. This proposal is similar in that it replaces the specific design requirements of R322.3 with reference to ASCE 24. A side-by-side comparison of the two sets of requirements was prepared, with the conclusion the differences are not substantive, in large part because several changes approved for the 2015 IRC were based on consistency with the 2014 edition of ASCE 24. One clear difference is ASCE 24 specifies shear walls, which are not permitted by Section R322.3.3 but may be appropriate for some townhomes to resist lateral loads in areas with seismic or high wind conditions.

Two subsections are proposed to be retained -- and renumbered (renumbering not shown in proposal). Section R322.3.6 Construction documents (renumbr to R322.3.2) is retained to meet the NFIP requirement that dwellings in coastal high hazard areas be designed and sealed by registered design professionals (renumber to

R322.3.1). Section R322.3.7 Tanks (renumber to R322.3.3), is retained because it has the an option to cantilever or knee-brace platforms to the building is not explicit in ASCE 24 (nor it is precluded).

NOTE: six sections are proposed to be deleed w ithout substitution; how ever, those sections have notes "No change to text."

Cost Impact: Will not increase the cost of construction
The IRC already requires dw ellings in coastal high hazard areas and Coastal A Zones to be prepared by registered design professionals. ASCE 24 provides more flexibility in design and that flexibility may result in some cost savings for some dw ellings.

RB157-16 : R301.2.4-WILSON12101

The highlighte text "not permitted" should not display as struck out.

RB234-16
IRC: R602.10.3.

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

2015 International Residential Code

TABLE R602.10.3 (2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR[a, b] [multiply length from Table R602.10.3(1) by this factor]	APPLICABLE METHODS
2	Roof eave-to-ridge height	Roof only	≤ 5 feet	0.70	All methods
			10 feet	1.00	
			15 feet	1.30	
			20 feet	1.60	
		Roof + 1 floor	≤ 5 feet	0.85	
			10 feet	1.00	
			15 feet	1.15	
			20 feet	1.30	
		Roof + 2 floors	≤ 5 feet	0.90	
			10 feet	1.00	
			15 feet	1.10	
			20 feet	Not permitted	