Building Code Action Committee (BCAC)
Structural Work Group

September 21-22, 2016

BCAC Public Comments (Agenda Item B2)

This report includes codes changes, report of hearing and public comments for code changes that are included in the matrix of code changes that the BCAC has proposed or has been monitoring as related issues.

Summary

BCAC has submitted 4 public comments:
S22, G32, EB55, RB295

There are public comments from others on the following BCAC:
S22, RB295

Public comments from others on related code changes are:
S19, S20, S296, RB22, RB298, RB299, RB300, RB301, RB302

S22-16
IBC: 1504.9 (New).

Proposed Change as Submitted

Proponent : Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org); Marc Levitan, National Institute of Standards and Technology (NIST), representing National Institute of Standards and Technology (marc.levitan@nist.gov)

2015 International Building Code

Add new text as follows:

1504.9 Surfacing and ballast materials in tornado-prone regions. Aggregate shall not be used as surfacing for roof coverings and aggregate, gravel or stone shall not be used as ballast on the roof of a Risk Category III or IV building located in areas where the wind speed is 250 MPH in accordance with Figure 304.2(1) of ICC 500.

Reason: Investigations of building performance following tornadoes have shown that loose aggregate, gravel and stone surfacing and ballast on roofs are significant contributors to building damage and injuries. In particular – Risk Category III and IV buildings such as schools and hospitals have often experienced significant glazing damage due to aggregate blow-off from their own roofs, and/or roofs of nearby buildings on their own campuses, in essence 'self-inflicted' damage. FEMA has also documented instances where people have been injured after being struck directly by roof aggregate in tornadoes, in Illinois (FEMA 2010) and Texas (FEMA 2007).

The proposed code change is consistent with findings and recommendations from the National Institute of Standards and Technology (NIST) technical investigation of the 2011 tornado in Joplin Missouri (NIST 2014, Finding 19, and Recommendation 10). This change proposal is also consistent with FEMA recommendations, developed from observations of building performance in tornadoes. FEMA recommends that aggregate roof surfacing not be specified for critical facilities in tornado-prone regions (FEMA 2012). The NIST and FEMA recommendations are intended to reduce the potential number of missiles generated by the tornado, and hence reduce the potential for building damage and injury to people.

Glazing damage to Risk Category III and IV type-buildings by roof aggregate blow off, including 'self-inflicted' damage, has been well documented in severe windstorms, both tornadoes (e.g., NIST 2014, and FEMA 2007, 2010, and 2012) and hurricanes (e.g., NIST 2006 and FEMA 2005). These buildings often experience little to no structural damage, but suffer catastrophic damage to the building interior and contents that can also result in injuries and fatalities. Such was the case at St. John's Regional Medical Center (SJRMC) in Joplin, Missouri. The main buildings at SJRMC consisted of two mid-rise hospital towers and several three and four story clinic and medical office buildings. Following the May 22, 2011 Joplin tornado, despite the fact that there was no significant structural damage to any of these buildings, 14 people died due to injuries sustained while inside the buildings, or succumbed later to their injuries, 12 of which were caused by "multiple blunt-force trauma to the body" according to the death certificates (NIST 2014, p. 261). Although there was debris from many sources, blown off roof aggregate from SJRMC buildings contributed significantly to damage to the building envelopes, allowing wind and rain and debris inside of buildings (see Figure 1a and b). "The damage to these buildings included the breakage of almost all vertical glass; damage to the roof systems, including the loss of aggregate roof ballast, which became wind–borne debris that further damaged the facility and the surrounding areas" (NIST 2014, p. 317).

Although none of the main buildings at SJRMC suffered any significant structural damage, the damage to the interiors was so great that the entire Medical Center was ultimately demolished and rebuilt at a different location. Many lessons learned from the tornado were incorporated in the design of the replacement facility, including NOT using roof aggregate, as reported below by Sickles (2014).

"A blanket of rock, with some pieces the size of a golf ball, was used to weigh down the roof on the old hospital, which was built in 1965. Those actually turned into projectiles during the tornado," Felton said of the gravel. "They were being shot right through the patient room windows." [Ryan Felton, project director with McCarthy Building Companies, the firm constructing the new facility].

There will be no rocks on Mercy's new roof, but a protective layer of lightweight concrete is being incorporated into the roofing scheme

Figure 2a and b shows another example of roof aggregate damaging the building it is supposed to be protecting. FEMA (2012) documented that aggregate from a one story section of a building at Ringgold High School was the likely source of damage to windows in a taller part of the same building during a 2011 tornado. Similarly, a hospital in Greensburg Kansas suffered glazing damage from aggregate from the ballasted single-ply membrane roofs (FEMA 2007) as shown in Figure 3. Pieces of the large aggregate (1 ½ inches in diameter, nominal) were found inside the building following the 2007 tornado.

It should be noted that the vast majority of aggregate blow-offs have occurred during hurricanes and tornadoes. The 2006 edition of IBC prohibited the use of aggregate in hurricane-prone regions. The 2006 edition also added Table 1504.4 (1504.8 in the 2015 edition), which is applicable to small aggregate used on built-up and sprayed polyurethane roofs outside of hurricane-

prone regions. Although improvements to the Table have been proposed (Crandall and Smith, 2009), it is believed that except for tornadoes, the potential for aggregate blow-off outside of hurricane-prone regions is generally small. Because the probability of a site specific tornado strike is very low, this proposal is limited to Risk Category III and IV buildings.

Although tornadoes generate many types of debris, an aggregate surfaced roof has a tremendous number of potential missiles. For example, a ballasted 20,000 square foot roof would have about 1.6 million loose aggregates. A similarly sized built-up roof would have about 4.5 to 9 million loose aggregates, depending upon gradation (based on aggregate samples collected from a number of roofs reported by FEMA (2006, p. 5-63)). Additionally, the aggregate problem can be easily mitigated, whereas other debris sources are much more difficult to mitigate.

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Note – The code change references a Figure in ICC 500. ICC 500 is a standard already referenced in the IBC for design and construction of storm shelters. Figure 304.2(1) of ICC 500 (Figure 4 below) provides a map of tornado wind speeds. The 250 mph wind speed region on that map, covering parts of the midwest and the southeast US generally known as "Tornado Alley" and "Dixie Alley" respectively, represent the most tornado-prone areas of the US.

Figure 1a - Glazing failures in hospital tower at SJRMC following the Joplin tornado (above); interior damage at SJRMC. Note the extensive amount of roof aggregate inside the building (below).

Source NIST

Figure 1b - Glazing failures in hospital tower at SJRMC following the Joplin tornado; interior damage at SJRMC. Note the extensive amount of roof aggregate inside the building.

Figure 2a - Aggregate scoured from the roof of the first story section of this high school building in Georgia during a tornado (above) likely broke the windows on the adjacent taller section of the same building (below).

Source: FEMA Mitigation Assessment Team

Figure 2b - Aggregate scoured from the roof of the first story section of this high school building in Georgia during a tornado likely broke the windows on the adjacent taller section of the same building.

Source: FEMA Mitigation Assessment Team

Figure 3 - Glazing damage at a hospital in Greensburg Kansas following a tornado in 2007. The craters shown in the right center pane and at the vehicle windshield were caused by the large aggregate blown from the ballasted single-ply membranes (FEMA 2012).

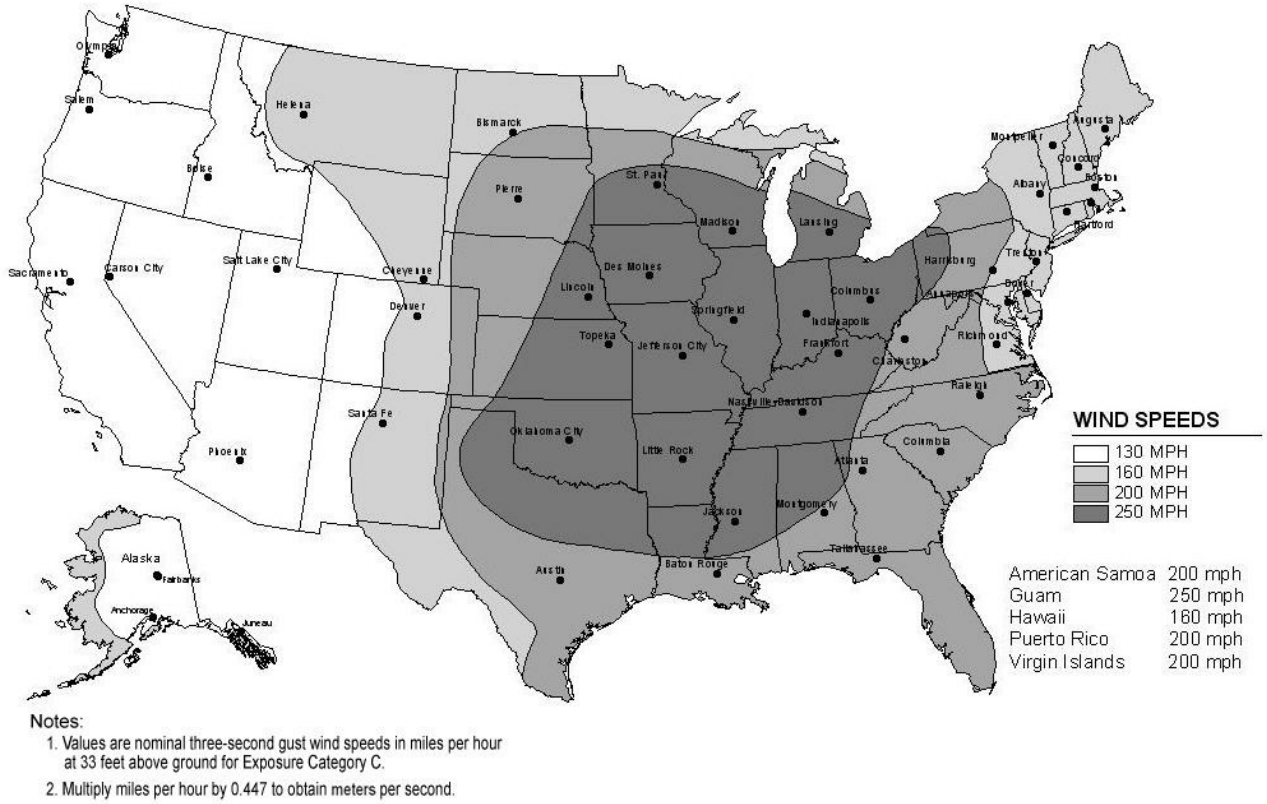


Figure 4 - Shelter Design Wind Speeds for Tornadoes - Source ICC 500-2014, International Code Council.

The ICC Building Code Action Committee (BCAC) is a co-proponent of this proposal. BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2014 and 2015 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: **BCAC** (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

Bibliography: References:

Crandell, J. H. and Smith, T.L. (2009), Design Method Improvements to Prevent Roof Aggregate Blow-off, P*roceedings of Hurricane Hugo 20th anniversary symposium on building safer communities – improving disaster resilience*, Applied Technology Council.

FEMA (2005). *Mitigation Assessment Team Report: Hurricane Charley in Florida.* FEMA 488. Federal Emergency Management Agency. April 2005. Available at https://www.fema.gov/media-library/assets/documents/905 (https://www.fema.gov/media-library/assets/documents/905).

FEMA (2007). *Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds:Providing Protection to People and Buildings*. FEMA 577. Federal Emergency Management Agency. June 2007 (see p. 4-123, and 4-126 to 4-140). Available at https://www.fema.gov/media-library/assets/documents/10672 (https://www.fema.gov/media-library/assets/documents/10672).

FEMA (2010). *Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds.* FEMA P-424. Federal Emergency Management Agency. December 2010 (see p. 6-23). Available at http://www.fema.gov/media-library/assets/documents/5264?id=1986 (http://www.fema.gov/media-library/assets/documents/5264?id=1986).

FEMA (2012). *Mitigation Assessment Team Report: Spring 2011 Tornadoes: April 25-28 and May 22 Building Performance Observations, Recommendations, and Technical Guidance.* FEMA P-908. Federal Emergency Management Agency. May 2012 (see Tornado Recovery Advisory 6, Appendix F, p. 5). Available at http://www.fema.gov/media-library/assets/documents/25810 (http://www.fema.gov/media-library/assets/documents/25810).

NIST (2006). *Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report*. NIST Technical Note 1476. National Institute of Standards and Technology June 2006. Available at http://www.nist.gov/customcf/get_pdf.cfm?pub_id=908281 (http://www.nist.gov/customcf/get_pdf.cfm?pub_id=908281).

NIST (2014). *Final Report, National Institute of Standards and Technology (NIST) Technical Investigation of the May 22, 2011, Tornado in Joplin, Missouri*. NIST NCSTAR-3. March 2014. Available at http://dx.doi.org/10.6028/NIST.NCSTAR.3 (http://dx.doi.org/10.6028/NIST.NCSTAR.3).

Cost Impact: Will increase the cost of construction
A variety of other types of roof systems are available for use on roofs of Category III and IV buildings located in the 250 mph area on Figure 304.2(1) of ICC 500. These alternative systems may or may not cost more than an aggregate surfaced or a ballasted roof system.

S22-16 : 1504.9 (NEW)-KULIK10961

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee beleives it does not make sense to restrict aggregate on roofs, using wind speed criteria that has not been used used in the design of the building.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

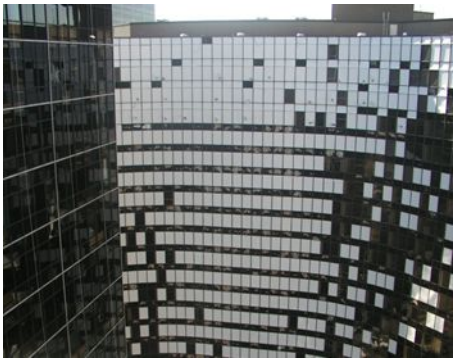
Proponent : Edwin Huston, representing National Council of Structural Engineers' Associations (NCSEA) (huston@smithhustoninc.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

1504.9 Surfacing and ballast materials in tornado-prone regions. Aggregate shall not be used as surfacing for roof coverings and aggregate, gravel or stone shall not be used as ballast on the roof of a ~~Risk Category III or IV~~ building located in areas where the wind speed is 250 MPH in accordance with Figure 304.2(1) of ICC 500.

Commenter's Reason: There was discussion among the Structural Committee during the 2018 IBC Code Development Hearings about the possibility of aggregate ballast, blown off of adjacent buildings of any Risk Category damaging a Risk Category III or IV building. While aggregate has been blown off of a building, and damaged the same building, it is also the case that aggregate ballast has been lifted from buildings, become airborne and damaged buildings downstream.
The proponent took the following photographs of glazing damage in New Orleans after Hurricane Katrina. The glazing damage in both of these buildings was caused by airborne gravel from adjacent, or nearby buildings.



[Add Photo 1 here]

New Orleans Hyatt Hotel: Gravel was removed from the hotel rooms and the windows were sealed with the white panels. The hotel finally reopened a year or so ago.

[Add Photo 2 here]

New Orleans Shopping Center Office Tower: Some unbroken windows had several "bullseye" fractures caused by gravel impacts that had not yet fractured the glazing. There were small piles of gravel at the base of the building which had struck the building, but had not yet broken windows. The proponent believes that after a sufficient number of "bullseye" damaging impacts, the glazing finally gives way.

The proponent freely admits that this is hurricane and not tornado damage, but the photographs from S22-16 clearly show glazing damage from tornados.

The Structural Engineers Association of Kansas and Missouri prepared a reconnaissance report after the May 22, 2011 Joplin, Missouri Tornado.

One of their recommendations was:

> **9) Codes should prohibit the *use of ballasted roofs with rock or crushed stone in all construction for tornado prone areas.***
>
> During high wind tornado events, loose roof ballast (gravel) is proven to be ineffective at preventing roof blow-off. This is noted during both hurricanes and tornadoes. Roof ballast often becomes airborne debris which typically destroys glazing systems and other brittle exterior finishes. This debris can injure innocent people. As noted above, during the inspection of the roofs at St. John's Medical Center, the ballast of the roof was shifted into piles, was blown into the glass, broke the facade and landed in many of the rooms on the west side of the building, ineffectively holding the roof membrane in place, while potentially overloading other structural portions of the roof. Many hurricane prone regions of the country have enforced codes restricting the use of them, based on the same determinations as mentioned above.

While S22 didn't go that far, it is certainly a step in the right direction.

Bibliography: Structural Engineers Association of Kansas and Missouri Report "Investigations and Recommendations based on the May 22, 2011Joplin, Missouri Tornado"

Public Comment 2:

Proponent : Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org); Marc Levitan (marc.levitan@nist.gov) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

1504.9 Surfacing and ballast materials in tornado-prone regions. Aggregate shall not be used as surfacing for roof coverings and aggregate, gravel or stone shall not be used as ballast on the roof of a Risk Category III or IV building located in ~~areas where~~ the region having the greatest wind speed ~~is 250 MPH~~ in ~~accordance with~~ Figure 304.2(1) of ICC 500.

Commenter's Reason: The Committee Reason for disapproval states:
"The committee believes it does not make sense to restrict aggregate on roofs, using wind speed criteria that has not been used in the design of the building."

The committee is incorrect in its understanding of the intent of this proposal.

The 250 mph wind speed zone on the ICC 500 map referenced in the code change proposal (see Figure 4) is ONLY used to geographically locate the most severe tornado-prone region of the US. We could have alternately used a map of tornado prone parts of the US developed using National Oceanic and Atmospheric Administration (NOAA) tornado climate data, and based on tornado occurrence rates instead of estimated maximum tornado wind speeds. For convenience, we instead chose to use a tornado hazard map that is already referenced in the IBC and delineates a similar region.

The intent of this code change is to reduce the windborne debris hazard, particularly to glazed openings, in tornado prone parts of the country, which is the same rationale behind the existing prohibition for aggregate in hurricane prone regions (IBC 2015 Section 1504.8). As described in more detail later in the reason statement, even a modest size aggregate surfaced or ballasted roof contains millions of potential windborne missiles, which have been documented to significantly contribute to building damage and injuries.

This proposal will have a small impact on the cost of construction. A variety of other types of roof systems are available for use on the roofs of Risk Category III and IV buildings in the tornado-prone region. These alternative systems may or may not cost more than aggregate-surfaced or ballasted roof systems.

The Applied Economics Office in the Engineering Laboratory at the National Institute of Standards and Technology conducted a study to determine the impacts of this proposal. This code change would only affect a comparatively small number of future roofs on Risk Category III and IV buildings in the tornado-prone region, which consists of all of Iowa, Missouri, Arkansas, Illinois, Indiana, Ohio, and parts of the surrounding states (see Figure 4), which could otherwise have built-up or ballasted EPDM roofs. This is estimated to be just 0.1% of all roof construction in the US, based on analysis of information from the National Roofing Contractors Association Annual Market Survey (NRCA 2016), EPDM Roofing Association (EPDMRA 2016), and building stock data (FEMA, 2000) from Hazus (assuming the distribution of building occupancy types for new construction follows the distribution for the existing building stock).

For comparison, the existing prohibition on aggregate-surfaced and ballasted roofs of all Risk Category buildings in hurricane prone regions (Section 1508 of IBC 2015) impacts about 4.6 times more buildings than the number of buildings potentially

impacted by this code change proposal.

Within the defined tornado prone region, roof construction on an estimated 0.2% of all buildings would potentially be affected.

References

Federal Emergency Management Administration (2009). HAZUS-MH MR4. Version 1.4. http://www.fema.gov/hazus.

National Roofing Contractors Association (2015). 2014-2015 NRCA Market Survey.

EPDM Roofing Association. Why EPDM? - Standard Attributes. Retrieved July 25, 2016 from http://www.epdmroofs.org/what-is-epdm/why-epdm/standard-attributes.

S22-16

IBC: 1504.4, 1504.8.

Proposed Change as Submitted

Proponent : Mike Ennis, representing SPRI Inc. (m.ennis@mac.com)

2015 International Building Code

Revise as follows:

1504.4 ~~Ballasted~~ Aggregate surfaced low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with Section 1504.8 and ANSI/SPRI RP-4. Aggregate surfaced built-up roofs and aggregate surfaced sprayed polyurethane foam roofing shall be designed in accordance with Section 1504.8.

1504.8 Aggregate. ~~Aggregate~~

Loose aggregate used as surfacing for roof coverings and aggregate, gravel, or stone used as ballast shall not be used on the roof of a building located in a ~~hurricane-prone~~ wind-borne debris region as defined in Section 202, or ~~on~~ any other building ~~with a mean roof~~ not meeting the aggregate size and building parapet height ~~exceeding that permitted by~~ requirements of Table 1504.8 ~~based on the exposure category and basic wind speed at the site~~.

TABLE 1504.8

~~MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED FOR BUILDINGS WITH AGGREGATE ON THE ROOF IN AREAS OUTSIDE A HURRICANE-PRONE REGION~~ Minimum Required Parapet Height (inches)[e] For Aggregate Surfaced Roof Coverings[a,b]

~~NOMINAL DESIGN WIND SPEED, V_{asd} (mph)[b, d]~~	~~MAXIMUM MEAN ROOF HEIGHT (ft)[a, c]~~		
	~~Exposure category~~		
	~~B~~	~~C~~	~~D~~
~~85~~	~~170~~	~~60~~	~~30~~
~~90~~	~~110~~	~~35~~	~~15~~
~~95~~	~~75~~	~~20~~	~~NP~~
~~100~~	~~55~~	~~15~~	~~NP~~
~~105~~	~~40~~	~~NP~~	~~NP~~
~~110~~	~~30~~	~~NP~~	~~NP~~
~~115~~	~~20~~	~~NP~~	~~NP~~
~~120~~	~~15~~	~~NP~~	~~NP~~
~~Greater than 120~~	~~NP~~	~~NP~~	~~NP~~

		WIND EXPOSURE AND NOMINAL DESIGN WIND SPEED $_{asd}$ (MPH)[c,d]														
ASTM Gradation	Mean RoofHeight[a] (ft)	Exposure B					Exposure C					Exposure D				
		85	90	100	110	120	85	90	100	110	120	85	90	100	110	120
ASTM	15	0	0	15	20	25	22	25	31	38	45	27	31	38	45	53
D1863	20	0	12	17	23	25	23	27	33	40	47	29	32	40	47	55
No. 7	30	13	15	21	27	32	26	29	36	44	51	31	35	43	50	58
or No. 67	40	15	18	24	29	35	28	31	39	46	53	33	37	45	52	60
	50	17	20	26	32	38	29	33	40	48	55	34	38	46	54	62
ASTM	60	18	21	28	34	40	30	34	42	49	57	35	39	47	56	64
D7655	80	21	24	30	37	43	32	36	44	52	60	37	41	49	58	66
No. 4	100	23	26	33	40	46	34	38	46	54	62	38	43	51	60	68
	125	25	28	35	42	49	36	40	48	56	64	40	44	53	62	70
	150	27	30	37	45	52	37	41	50	58	66	41	45	54	63	72
ASTM	15	0	0	11	15	20	16	19	25	31	37	22	25	31	38	45
D1863	20	0	0	13	17	22	18	21	27	34	40	23	26	33	40	47
No. 6	30	0	11	16	21	26	20	24	30	36	43	25	29	36	43	50
	40	0	13	18	24	29	22	25	32	39	45	27	30	37	45	52
	50	12	15	20	26	31	23	27	34	40	47	28	31	39	46	53
	60	13	16	22	28	33	24	28	35	42	49	29	33	40	47	55
	80	16	19	25	30	36	26	30	37	44	51	30	34	42	50	57
	100	18	21	27	33	39	28	31	39	46	53	32	36	43	51	59

	125	19	23	29	35	42	29	33	40	48	55	33	37	45	53	61
	150	21	24	31	37	44	30	34	42	50	57	34	38	46	54	62

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

~~a. Mean roof height as defined in ASCE 7.~~
~~b. For intermediate values of V_{asd}, the height associated with the next higher value of V_{asd} shall be used, or direct interpolation is permitted.~~
~~c. NP = gravel and stone not permitted for any roof height.~~
~~d. V_{asd} shall be determined in accordance with Section 1609.3.1.~~

a. Interpolation between wind speeds and mean roof heights as defined in ASCE 7 shall be permitted.
b. Aggregate surfaced roofs shall not be permitted for V_{asd} wind speeds greater than 120 mph, or where the building height exceeds 150 feet.
c. Wind exposure shall be determined in accordance with Chapter 16,
d. V_{asd} shall be determined in accordance with Section 1609.3.1
e. Where the minimum required parapet height is indicated to be 0 inches (0mm), a gravel stop shall be provided that extends a minimum 2 inches from the roof surface, but not less than the height of the aggregate.

Reason: Reason: Requirements for the use of aggregate surfaced roofs were revised in the IBC in 2006 and 2009. These revised requirements are not based on the K-W design method (Kind Wardlaw 1976), the wind tunnel studies underlying the K-W design method (Kind 1977), or a quantitative analysis of observed good and bad roofing system performances in real wind events. Instead, current building code requirements are based on variation in surface pressure with building height which is known to be an inappropriate predictor of aggregate blow-off or scour due to pressure equalization effects (Smith, 1997). Furthermore, these recent requirements do not address critical parameters such as aggregate size and parapet height which govern performance. This code change proposal replaces the current Table 1504.8 with one based on the K-W design method and new research by the Asphalt Roofing Manufacturers Association (ARMA) (Crandell Fischer RCI 2010) . Results demonstrate that the use of aggregate-surfaced roofing systems is a viable option in high wind areas with appropriate aggregate sizing and parapet design. The Kind-Wardlaw design method has been simplified, improved, and calibrated to a number of field observations to refine its application to low-slope, built-up roof (BUR) and sprayed polyurethane foam (SPF) roof systems (Crandell Smith Hugo Conference 2010).
The proposed Table addresses the critical parameters of aggregate size and parapet height.

Two types of roof coverings: ballasted single ply roofs and those with aggregate surfaces, such as Builtup roofs (BUR) and certain spray polyurethane roof systems are covered by this Table. Over 6 billion square feet of ballasted single ply roofing applications have been installed over the last two decades The vast majority of these systems have performed very well with respect to their resistance to wind pressure loads. However some damage has been observed due to aggregate blowing off non-code compliant roofs during high wind events. The proposed Table is based on over 200 wind tunnel tests in addition to over 40 years of field experience and observations from hurricane investigation teams. The proposed Table, and the remaining portions of Section 1504.8 provide restrictions on the use of ballasted single ply roof systems that will allow for the responsible use of aggregate surfacing that is a cost effective method to keep the roof system in place and to improve the energy performance of the building.

Bibliography: REFERENCES:
Crandell, J. H. and Smith, T.L.. (2010) Design Method Improvements to Prevent Roof Aggregate Blow-Off, Hugo Conference

International Building Code. Falls Church, VA

Kind, R.J. and Wardlaw R.L. (1976). Design of Rooftops Against Gravel Blow-Off. National Aeronautical Establishment, National Research Council, Canada. Kind, R.J. (1977). Further Wind Tunnel Tests on Building Models to Measure Wind Speeds at Which Gravel is Blown Off Rooftops. LTR-LA-189. National Aeronautical Establishment, National Research Council, Canada.

Smith, T.L. (June 1997). Aggregate Blow-Off from BUR and SPF Roofs: Recognizing the Potential Hazards and Avoiding Problems. Proceedings of The 8th U.S. Conference on Wind Engineering, AAWE. SPRI (2008). Wind Design Standard for Ballasted Single-Ply Roofing Systems.

Crandell, J. H. and Fischer, M. (2010) Winds of Change: Resolving Roof Aggregate Blow-Off, RCI Conference

Cost Impact: Will not increase the cost of construction
This proposal will provide additional design options for aggregate surfaced roofs and will not increase the cost of construction.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While the committee felt this proposal is headed in the right direction, the amount of conflicting testimony indicates that work is needed on these requirements, a revised version should be submitted in the public comment phase. Questions were raised on how the research results have been turned into code provisions. As formatted with options for wind speed, exposure and roof heights the table is complex and a more simplified, straightforward table that is not so exhaustive would be preferrable even if it is more conservative. Due to the difficulty reading the column with ASTM gradation, it could be preferrable to split this into two tables. There is also a concern over whether the reference to a specific product type is appropriate.

Assembly Motion: **As Submitted**
Online Vote Results: **Failed**
Support: 33.46% (91) Oppose: 66.54% (181)
Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Single-Ply Roofing Industry (jcrandell@aresconsulting.biz) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

1504.4 Aggregate surfaced low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Sections 1507.12 and 1507.13 shall be designed in accordance with Section 1504.8 and ANSI/SPRI RP-4. ~~Aggregate surfaced built-up roofs and~~ Other aggregate surfaced ~~sprayed polyurethane foam roofing~~ roofs shall be designed in accordance with Section 1504.8.

Commenter's Reason: The IBC structural committee indicated that this proposal was "heading in the right direction" and recommended that a public comment be developed to address the indicated concerns. The concerns are being addressed in two PCs. This first PC is editorial and removes reference to a specific roof material type in Section 1504.4. Now, aggregate surfaced roofs are generically referenced as appropriate. A second (separate) PC addresses the committee's recommendation to simplify and improve readability of the table (which was partly a font size or CDP access table formatting issue). It also provides additional information regarding the development of the S19 proposal as requested by the committee.

Public Comment 2:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Single-Ply Roofing Industry (jcrandell@aresconsulting.biz) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

~~**TABLE 1504.8**~~
~~**Minimum Required Parapet Height (inches)[e] For Aggregate Surfaced Roof Coverings[a,b]**~~

TABLE 1504.8
MINIMUM REQUIRED PARAPET HEIGHT (inches) FOR AGGREGATE SURFACED ROOF COVERINGS [a,b,c]

Aggregate Size	Mean Roof Height[a]	WIND EXPOSURE AND NOMINAL DESIGN WIND SPEED, V_{asd} (MPH) [d,e]									
		Exposure B					Exposure C[f]				
		85	90	100	110	120	85	90	100	110	120
ASTM D1863 (No.7 or No.67) or ASTM D7655 (No.4)	15	0	0	15	20	25	22	25	31	38	45
	20	0	12	17	23	28	23	27	33	40	47
	30	13	15	21	27	32	26	29	36	44	51
	50	17	20	26	32	38	29	33	40	48	55
	100	23	26	33	40	46	34	38	46	54	62

	150	27	30	37	45	52	37	41	50	58	66
ASTM D1863 (No.6)	15	0	0	11	15	20	16	19	25	31	37
	20	0	0	13	17	22	18	21	27	34	40
	30	0	11	16	21	26	20	24	30	36	43
	50	12	15	20	26	31	23	27	34	40	47
	100	18	21	27	33	39	28	31	39	46	53
	150	21	24	31	37	44	30	34	42	50	57

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

a. Interpolation between wind speeds and mean roof heights as defined in ASCE 7 shall be permitted.

b. Aggregate surfaced roofs shall not be permitted for V_{asd} wind speeds greater than 120 mph, or where the building height exceeds 150 feet.

c. Where the minimum required parapet height is indicated to be 0 inches (0 mm), a gravel stop shall be provided that extends a minimum of 2 inches from the roof surface, but not less than the height of the aggregate.

d. Wind exposure shall be determined in accordance with Chapter 16.

e. V_{asd} shall be determined in accordance with Section 1609.3.1.

f. For exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C.

Commenter's Reason: The IBC structural committee indicated that this proposal was "heading in the right direction" and recommended that a public comment be developed to address the indicated concerns. The concerns are being addressed in two PCs. The first PC (separate) removes reference to a specific roof material type in the text of Section 1504.4. This second PC addresses the committee's recommendation to simplify and improve readability of the table (which was partly a font size or CDP access table formatting issue). These revisions are technically consistent with the original proposal and the referenced research.

The committee also mentioned that questions were raised with regard to how the provisions were developed from the referenced research. The methodology (and design procedure) is clearly documented in the referenced research in an understandable, repeatable, and scientific manner (see original proposal for referenced research reports and papers). The procedure used is consistent with the findings of many wind tunnel studies and uses the same principles as applied in the ANSI/SPRI RP-4 standard currently referenced in the code. It is also consistent with the treatment of aggregate blow-off when incorporated in wind risk models. Furthermore, the analytical procedure was evaluated by comparison to numerous documented field studies of successful and failed loose aggregate surfaced roofs systems in various high wind events to confirm its ability to reliably predict performance as a means to design roofs (or develop prescriptive provisions as proposed) to prevent roof aggregate blow-off. Thus, a robust combination of current engineering practice, wind tunnel data, and field research was used to support development of the requirements as proposed for Table 1504.8.

However, this proposal does not merely provide a more academic solution. It is necessary to correct deficiencies in the current code provisions. For example, the current Table 1504.8 allows buildings up to 170' tall or buildings in areas with design wind speeds up to 120 mph with NO PARAPET which creates a general safety hazard (e.g., falling debris from the roof) and unacceptable wind damage vulnerability (i.e., aggregate blow-off risk). This proposal corrects this safety and building performance issue based on correct scientific principles and sound engineering practices. For example, buildings with loose aggregate surfaced roofs in a 120 mph wind zone would be required to have parapets with heights ranging from 20 inches (minimum for 15' mean roof height and wind exposure B with the large aggregate size specified) to 72 inches (maximum for 150' mean roof height and wind exposure D with the smaller aggregate size permitted). Similar improvements are made for lesser wind speed conditions as shown in proposed Table 1405.8. This is a significant improvement over 0 inches (no parapet) as currently allowed in the code.

If implemented, this proposal will serve to prevent many past observations of roof aggregate blow-off from being repeated. Simply put, this proposal is implementing lessons learned in a rational, scientific manner based on real-world and wind tunnel laboratory data to prevent history from repeating itself in an unfavorable manner. Any argument against this proposal as being inadequate is an argument to leave the code in a far worse condition from a building safety and performance standpoint.

Proponent : Scott Campbell, representing Portland Cement Association (scampbell@cement.org) requests Approve as Submitted.

Commenter's Reason: This proposal uses the latest research to improve the design for aggregate surfaced low slope roofs. In addition, the design moves towards considering parapet height, and not just roof height, which is in line with what factors

actually affect the performance of aggregate roof systems. The proposed change would increase public safety and property protection.

S19-16

S20-16
IBC: 1504.8.

Proposed Change as Submitted

Proponent : Mike Fischer, Kellen, representing Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com)

2015 International Building Code

Revise as follows:

1504.8 Aggregate. ~~Aggregate~~
Loose-laid aggregate used as surfacing for roof coverings and aggregate, gravel or stone used as ballast shall not be used on the roof of a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site.

Exception. Aggregate shall be permitted on roofs located outside of the windborne debris region using *approved* parapet design to control aggregate blow-off, when the parapet systems have been designed by a *registered design professional*.

Reason: The use of aggregate on roofs has been the subject of debate for the past decades as post-storm evaluations of building performance has led to significant restrictions to the use of roofing aggregate, despite research that provides recommendations on the use of parapets to prevent roof aggregate blow-off under design conditions.
The proposal provides an option for the use of aggregate when the roof system has an engineered parapet control system. It further limits the current aggregate restrictions to loose-laid aggregate; there are methods in use for the embedment of aggregate into the roofing material such as asphalt built-up roof systems approved for use under the Florida Building Code.

Cost Impact: Will not increase the cost of construction
The proposal provides greater product availability due to increased flexibility.

S20-16 : 1504.8-FISCHER13529

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The wording of the proposed exception for aggregate on roofs has problems with enforceability. There is a question on what is meant by "controlling" aggregate blow-off and no prescriptive requirements are provided to make this clear. Another concern was raised over the use of the term "parapet systems".

Assembly Motion: **As Modified**
Online Vote Results: **Failed**
Support: 20.3% (55) Oppose: 79.7% (216)
Assembly Action: **None**

Online Floor Modification:

1504.8 Aggregate. ~~Loose-laid~~ aggregate used as surfacing for roof coverings and aggregate, gravel or stone used as ballast shall not be used on the roof of a building located in a hurricane-prone region as defined in Section 202, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the site.

Exception. Aggregate shall be permitted on roofs located outside of the windborne debris region using *approved* parapet design to control aggregate blow-off, when the parapet systems have been designed by a*registered design professional*.

Individual Consideration Agenda

Proponent : Mike Fischer, Kellen, representing Asphalt Roofing Manufacturers Association (mfischer@kellencompany.com) requests Approve as Submitted.

Commenter's Reason: Roofing aggregate has been appropriately used for many decades, and the current code provisions are flawed- the code permits aggregate to be used without parapet control while overly restricting this product in hurricane-prone regions. The proposal provides guidance to the code official on a means to accept engineered design. The alternate means and methods provisions in the IBC lack detail on specific applications; this proposal will solve that need.

S20-16

G32-16

IBC: 423.1, 423.1.1, 423.2, 423.3, 423.4, 1604.5.

Proposed Change as Submitted

Proponent : Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org); Marc Levitan, National Institute of Standards and Technology (NIST) (marc.levitan@nist.gov); Andrew Herseth, representing Federal Emergency Management Agency (andrew.herseth@fema.dhs.gov)

2015 International Building Code

Revise as follows:

423.1 General. In addition to other applicable requirements in this code, ~~storm shelters~~*storm shelters* shall be constructed in accordance with ICC 500. Buildings or structures that are designated as emergency shelters by the emergency management official having jurisdiction shall also comply with Table 1604.5.

423.1.1 Scope. This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as safe rooms within buildings for the purpose of providing safe refuge from storms that produce high winds, such as tornados and hurricanes. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters.

423.2 Definitions. The following terms are defined in Chapter 2:

STORM SHELTER.

Community storm shelter.

Residential storm shelter.

423.3 Critical emergency operations. In areas where the shelter design wind speed for tornados in accordance with Figure 304.2(1) of ICC 500 is 250 MPH, 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations shall ~~have~~ comply with Table 1604.5 and shall be provided with a storm shelter constructed in accordance with ICC 500.

Exception: Buildings meeting the requirements for shelter design in ICC 500.

423.4 Group E occupancies. In areas where the shelter design wind speed

for tornados is 250 MPH in accordance with Figure 304.2(1) of ICC 500, all Group E occupancies with an aggregate occupant load of 50 or more shall have a storm shelter constructed in accordance with ICC 500. The shelter shall be capable of housing the total occupant load of the Group E occupancy.

Exceptions:

1. Group E day care facilities.
2. Group E occupancies accessory to places of religious worship.
3. Buildings meeting the requirements for shelter design in ICC 500.

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

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to:
	• Agricultural facilities.
	• Certain temporary facilities.
	• Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:
	• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.
	• Buildings and other structures containing Group E occupancies with an occupant load greater than 250.
	• Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500.

III	• Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities.
	• Group I-3 occupancies.
	• Any other occupancy with an occupant load greater than 5,000.[a]
	• Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV.
	• Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that:
	Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and
	Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to:
	• Group I-2 occupancies having surgery or emergency treatment facilities.
	• Fire, rescue, ambulance and police stations and emergency vehicle garages.
	• Designated[c] emergency shelters including earthquake or *community storm*~~, hurricane or other emergency~~*shelters* for use during and immediately after an event.
	• Designated[c] emergency preparedness, communications and operations centers and other facilities required for emergency response.
	• Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
	• Buildings and other structures containing quantities of highly toxic materials that:
	Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code;* and
	Are sufficient to pose a threat to the public if released.[b]
	• Aviation control towers, air traffic control centers and emergency aircraft hangars.
	• Buildings and other structures having critical national defense functions.

	• Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.1.2 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.
c. As designated by the emergency management official having jurisdiction.

Reason: The purpose of this code change is to clarify which types of shelters are required to be assigned to Risk Category IV per Table 1604.5 and who is responsible for providing the designation.
Risk categories are assigned to buildings to account for consequences and risks to human life (building occupants) in the event of a building failure. The intent is to assign higher risk categories, and hence higher design criteria, to buildings or structures that, if they experience a failure, would inhibit the availability of essential community services necessary to cope with an emergency situation and therefore have grave consequences to either the building occupants or the population around the building or structure that relies upon the provided services (such as a power station).

Table 1604.5 of the IBC, which was originally copied from Table 1.5-1 of ASCE 7 and has existed in the IBC since the 2000 edition, includes under Risk Category IV "Designated earthquake, hurricane or other emergency shelters". This item has always meant shelters that are used both during and immediately after an event. The item is amended to clarify that both uses apply.

Additionally, with the introduction of ICC-500 Standard for the Design and Construction of Storm Shelters (ICC 500) in 2008, and subsequently in 2014, the term 'hurricane shelter' is now used in Section 423 of the IBC and throughout ICC 500. Without the clarification of the word 'community' proposed above, ALL hurricane shelters would have to be Risk Category IV,

even residential hurricane shelters (shelters provided in dwelling units and having an occupant load not exceeding 16 persons), which does not meet the intent of Risk Category IV buildings.

Furthermore, with the introduction of ICC 500, the term 'storm shelter' has become a defined term and includes tornado shelters in addition to hurricane shelters, both of which are emergency shelters and as such meet the spirit and intent of being Risk Category IV structures.

The addition of footnote C is intended to provide clarification and meaning to the term 'designated' provided in the table; without this added footnote one may ask, 'designated by whom?' Another observed issue with the term 'designated', is that the designation often comes well after the building is designed and built, which is too late to incorporate the structural design provision of Risk Category IV. This clarification will lead to pre-design involvement of the emergency management official having jurisdiction, whom is typically the one that designates emergency shelters.

It is noted that, starting with the 2010 edition of ASCE 7, Table 1.5-1 no longer provides bulleted lists of the types of buildings that fall under each Risk Category. It was the decision of the ASCE 7 committee that Table 1.5-1 should only provide the general criteria, and that Table 1604.5 of the IBC should detail the specific occupancies or uses that fall under each Risk Category as decided on by the stakeholders and participants in the ICC code development process.

The ICC Building Code Action Committee (BCAC) is a co-proponent of this proposal. BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2014 and 2015 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: **BCAC** (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

Cost Impact: Will not increase the cost of construction

As this is intended as a clarification only, the cost of construction will not be increased.

G32-16 : 423.1-KULIK10973

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While there is support for the concept of clarifying the assignment of risk category to shelters, the proposed wording was felt to be confusing. The proposal would introduce undefined terms into the IBC, designating people to do things who are not under the control of the building official. The new wording proposed in Section 423.1 is problematic, naming an emergency management official and suggesting that only such buildings comply with Table 1604.5 when, in fact, all buildings need to comply. With respect to the building code the actual chain of command for emergency management in any locale is not know.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

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

Modify as Follows:

2015 International Building Code

423.1 General. In addition to other applicable requirements in this code, *storm shelters* shall be constructed in accordance with ICC 500. Buildings or structures that are also designated as emergency shelters ~~by the emergency management official having jurisdiction~~ shall also comply with Table 1604.5 as Risk Category IV structures.

423.1.1 Scope. This section applies to the construction of storm shelters

constructed as separate detached buildings or constructed as safe rooms within buildings for the purpose of providing safe refuge from storms that produce high winds, such as tornados and hurricanes during the storm. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Design of facilities for use as emergency shelters after the storm are outside the scope of ICC 500 and shall comply with Table 1604.5 as a Risk Category IV Structure.

423.2 Definitions. The following terms are defined in Chapter 2:

STORM SHELTER.

Community storm shelter.

Residential storm shelter.

423.3 Critical emergency operations. In areas where the shelter design wind speed for tornados in accordance with Figure 304.2(1) of ICC 500 is 250 MPH, 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations shall comply with Table 1604.5 as a Risk Category IV structure and shall be provided with a storm shelter constructed in accordance with ICC 500.

~~**Exception:** Buildings meeting the requirements for shelter design in ICC 500.~~

-

Commenter's Reason: The intent of the original code change proposal was to simply clarify that shelters built for protection during wind storms in accordance with ICC500-14 are not emergency shelters that are required to be designed as Risk Category IV structures in accordance with Section 1604.5. The committee disapproved this proposal because the proposed text introduced requirements for an emergency management official to designate an emergency shelter. It was not the intent of the BCAC to create requirements for emergency personnel and introduce some level of management for emergency shelters. Therefore, this public comment is intended to remove the reference to emergency management officials in Section 423.1 and instead install language in Section 423.1.1 that simply clarifies the scope of ICC500. In addition, in Section 423.3 the phrase "as a Risk Category IV structure" is added to clarify how this type of structure is required to comply with Table 1604.5.

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

G32-16

S296-16
IBC: 2407.1.1.

Proposed Change as Submitted

Proponent : Jonathan Siu, City of Seattle Department of Construction & Inspections, representing Washington Association of Building Officials Technical Code Development Committee (jon.siu@seattle.gov)

2015 International Building Code

Revise as follows:

2407.1.1 Loads. The panels and their support system shall be designed to withstand the loads specified in Section 1607.8~~. A design~~ , using a safety factor of four ~~shall be used for safety~~.

Reason: The purpose of this proposal is to return the code language to well-recognized terms, and eliminate terms that have no meaning to the engineers that will be performing the designs of these panels and supports.
In the last cycle, proposal S300-12 was Approved as Submitted at the Final Action Hearings. That proposal substituted the phrase, "design factor...for safety" for "safety factor." The latter is a well-recognized engineering term, whereas the former is not. Unfortunately, there was no opportunity at the FAH to make any changes to the proposal, editorial or otherwise.

This proposal does not change the meat of the code or the intent of S300-12, but is an editorial change that will be more understandable to the engineering community who will be responsible for these designs.

Cost Impact: Will not increase the cost of construction
This is an editorial change to clarify the code. It does not change any requirements of the code, and therefore, has no cost impact.

S296-16 :
2407.1.1-
SIU11093

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: approval is consistent with action taken on S295-16.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponent : Jonathan Siu, representing City of Seattle Department of Construction and Inspections (Jon.Siu@seattle.gov) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Building Code

2407.1.1 Loads. The panels and their support system shall be designed to withstand the loads specified in Section 1607.8~~,~~ . Glass guard elements shall be designed using a safety factor of four.

Commenter's Reason: This public comment corrects the original proposal, and clarifies to which elements in a glass guard system the safety factor of 4 is to be applied. The proposed change was intended to be purely editorial. However, as written by the proponent and approved by the Committee, the proposal incorrectly made clear the safety factor was to be applied to the structural elements supporting the glass guard elements.
A safety factor of 4 is necessary for glass elements because it is known there can be an extreme variation in structural properties for glass. Any small defect can cause the glass to fail prematurely--something that is not desireable for an element that is supposed to keep a person from falling. However, it is not necessary to design the non-glass guard elements for same safety factor, since their structural properties are much more predictable. For those non-glass elements, normal safety factors built into their structural design parameters would be adequate. We do not believe it is the intent of the code to penalize other structural elements of guards, just because they are supporting glass. It is to be noted that if the supports for a glass guard system (top rail, connections, etc.) are required to be designed for a safety factor of 4, it will be extremely difficult to comply with the code.

EB25-16

[BS] 403.4.1, TABLE 403.5 (New), [BS] 907.4.3, TABLE 907.5 (New)

Proposed Change as Submitted

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

2015 International Existing Building Code

Delete and substitute as follows:

[BS] ~~403.4.1~~ 403.5 ~~Seismic Design Category F~~ Mitigation priorities. ~~Where the portion of the building undergoing the intended alteration exceeds 50 percent of the aggregate area of the building, and where the building is assigned to Seismic Design Category F, the structure of the altered building shall be shown to meet the earthquake design provisions of the *International Building Code*. For purposes of this section, the earthquake loads need not be taken greater than 75 percent of those prescribed in Section 1613 of the *International Building Code* for new buildings of similar occupancy, purpose and location. New structural members and connections required by this section shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.~~

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

TABLE 403.5

Mitigation Priorities for Major Alterations

Priority Type	Occupancy	Risk Category	Seismic Design Category	Size	Location	Structural Attribute	Age	Other
SDC F	-	IV	F	-	-	-	-	-

[BS] ~~907.4.3~~ 907.5 ~~Seismic Design Category F~~ Mitigation Priorities. ~~Where the building is assigned to Seismic Design Category F, the evaluation and analysis shall demonstrate that the lateral load-resisting~~

~~system of the altered building or structure complies with reduced *International Building Code*-level seismic forces in accordance with Section 301.1.4.2 and with the wind provisions applicable to a limited structural alteration.~~

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

TABLE 907.5

Mitigation Priorities for Level 3 Alterations

Priority Type	Occupancy	Risk Category	Seismic Design Category	Size	Location	Structural Attribute	Age	Other
SDC F	-	IV	F	-	-	-	-	-

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

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

So if it's just editorial, why do it? To clarify the larger intent of these two code sections: That for certain buildings -- which might vary by jurisdiction -- a Level 3 alteration should come with a lateral system evaluation or retrofit. The current provisions do this for essential facilities in high seismic areas (SDC F buildings). But as demonstrated and proposed in a recent report by the Earthquake Engineering Research Institute (see Bibliography), building owners, code officials, and emergency planners expect the code to do more. When the life of a building is substanially extended through a major architectural renovation or mechanical upgrade, all at significant expense, owners, tenants, and the public expect that the building department will have reviewed the building's safety for earthquakes and hurricanes too. Some large jurisdictions do have such triggers for "major alterations," but they are mostly holdovers from local amendments developed before the old "25-50 rule" was removed in the late 1970s. Other jurisdictions large and small would like to do the same, but with limited resources and amendment-free adoption policies in place, their task is difficult.

The new format proposed here will help them. A single table is provided, and it is easily revised by adding one or more rows. There is no need to write new (and possibly flawed) code language, to figure out where it goes in the code, to write corresponding technical criteria and administrative regs, to match the local priority to some precedent already in the code, etc. All the benefits of the I-codes come with the proposed table.

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

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

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

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

Bibliography: "Alterations and Seismic Upgrade: The Building Code as Mitigation Policy," by David Bonowitz, David McCormick, and Peter Somers, 2014.
https://www.eeri.org/products-page/endowment-fund-reports/alterations-and-seismic-upgrade-the-building-code-as-mitigation-policy/

Cost Impact: Will not increase the cost of construction
Reorganization and alternate presentation only. MIGHT increase the cost of construction if using the Prescriptive method in an area of high seismicity where wind loads nevertheless control. But that change is proposed here only to ensure consistency between the IEBC compliance methods. Whether to add a wind trigger to the Prescriptive method is being proposed separately, and in that proposal, the cost impact is shown as "Will increase."

EB25-16 : [BS] 403.4.1-BONOWITZ13175

Public Hearing Results

Committee Action: **Disapproved**

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

Assembly Action: **None**

Individual Consideration Agenda

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

Commenter's Reason: The IBC Structural committee was very complimentary of EB25 and only disapproved it because the proposal doesn't go far enough in telling jurisdictions how they should locally amend the model code -- but that's for YOU to do, as needed for your city, county, or state. In effect, the committee liked this proposal but disapproved it because as the proponent, we didn't overstep our bounds! As a result, you won't get to benefit from what the committee recognized as a clarifying, simplifying, innovative, and useful proposal -- unless you reverse their disapproval.

To be clear, EB25 does not make any substantive change to the code. Nor does it require any jurisdiction to add mitigation triggers or add rows to the proposed table. All it does it reformat the existing provision to clarify the code's current mitigation priorities and to help jurisdictions take advantage of a clearer provision -- AS EACH JURISDICTION SEES FIT.

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

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

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

As for a roadmap to resilience-based mitigation programs, again, that would have been way beyond the scope of the proposal. The lack of such an over-reaching roadmap is an invalid basis for disapproving an otherwise helpful proposal.

In brief, the committee turned down a free car because it didn't come with driving lessons. They declined free playoff tickets because they didn't come with a "roadmap" to the stadium. They rejected a very good proposal because it was not perfect in the eyes of a few members -- and in doing so, they assumed that you wouldn't want that very good proposal either.

EB25-16

EB55-16

IEBC: [BS] 1201.2, [BS] 1206.1.

Proposed Change as Submitted

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

2015 International Existing Building Code

[BS] 1201.2 Report. A *historic building* undergoing *repair*, *alteration*, or *change of occupancy* shall be investigated and evaluated. If it is intended that the building meet the requirements of this ~~chapter~~ code, a written report shall be prepared and filed with the *code official* by a registered design professional when such a report is necessary in the opinion of the *code official*. Such report shall be in accordance with Chapter 1 and shall identify each required safety feature that is in compliance with this chapter and where compliance with other chapters of these provisions would be damaging to the contributing historic features. For buildings assigned to Seismic Design Category D, E or F, a structural evaluation describing, at a minimum, the vertical and horizontal elements of the lateral force-resisting system and any strengths or weaknesses therein shall be prepared. Additionally, the report shall describe each feature that is not in compliance with these provisions and shall demonstrate how the intent of these provisions is complied with in providing an equivalent level of safety.

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

Exceptions: ~~**Exception:**~~

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

Reason: There is a very weak link in Chapter 12 between the report that is required in Section 1201.2 and flexibility given to the structural aspect of historic buildings. Currently Section 1206.1 gives the impression that full compliance with the work area method is required regardless of any report in Section 1201.2 being developed.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2014 and 2015 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: **BCAC** (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

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

EB55-16 : [BS] 1201.2-KULIK10984

Public Hearing Results

Committee Action: **Disapproved**

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

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

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

Modify as Follows:

2015 International Existing Building Code

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

Exceptions:

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

2. Where compliance with the intent of this code is accomplished and documented in accordance with ~~Section~~ Sections 1201.2, 1202 and 1205.

Commenter's Reason: The committee felt that the change proposed to Section 1206.1 was appropriate, but the proposed exception #2 needed to also make a cross reference to Section 1202 and 1205 to correlate with previous actions regarding minimum repair or change of occuancy requirements. The BCAC agrees that this is an appropriate reference; therefore, this public comment includes that cross reference.
This public comment is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. Between 2014 and 2016 the BCAC has held 8 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed public comments. Related documentation and reports are posted on the BCAC website at: BCAC (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

EB55-16

RB22-16

IRC: R301.2.2, R301.2.2.1, R301.2.2.1.1, R301.2.2.1.2, R301.2.2.2.

Proposed Change as Submitted

Proponent : James Bela, representing Oregon Earthquakie Awareness (sasquake@gmail.com)

2015 International Residential Code

Revise as follows:

R301.2.2 Seismic provisions. The seismic provisions of this code shall apply as follows:

1. ~~*Townhouses* in Seismic Design Categories C, D_0, D_1 and D_2.~~
2. ~~Detached one- and two-family *dwellings* in Seismic Design Categories, D_0, D_1 and D_2.~~
1. *Townhouses* with a lateral design strength coefficient of .15 and greater.
2. Detached one- and two-family *dwellings* with a lateral design strength coefficient of .20 and greater.

R301.2.2.1 Determination of ~~seismic~~ lateral design ~~category~~ strength coefficient. Buildings shall be assigned a ~~seismic~~ lateral design ~~category~~ strength coefficient in accordance with Figure R301.2(2).

Delete without substitution:

~~**R301.2.2.1.1 Alternate determination of seismic design category.** The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} shown in Figure R301.2(2) are based on soil Site Class D, as defined in Section 1613.3.2 of the *International Building Code*. If soil conditions are other than Site Class D, the shortperiod design spectral response accelerations, S_{DS}, for a site can be determined in accordance with Section 1613.3 of the International Building Code. The value of S_{DS} determined in accordance with Section 1613.3 of the International Building Code is permitted to be used to set the seismic design category in accordance with Table R301.2.2.1.1, and to interpolate between values in Tables R602.10.3(3), R603.9.2(1) and other seismic design requirements of this code.~~

TABLE R301.2.2.1.1
SEISMIC DESIGN CATEGORY DETERMINATION

CALCULATED S_{DS}	SEISMIC DESIGN CATEGORY
$S_{DS} \le 0.17g$	A
$0.17g < S_{DS} \le 0.33g$	B
$0.33g < S_{DS} \le 0.50g$	C
$0.50g < S_{DS} \le 0.67g$	D_0
$0.67g < S_{DS} \le 0.83g$	D_1
$0.83g < S_{DS} \le 1.25g$	D_2
$1.25g < S_{DS}$	E

R301.2.2.1.2 Alternative determination of Seismic Design Category E. Buildings located in Seismic Design Category E in accordance with Figure R301.2(2) are permitted to be reclassified as being in Seismic Design Category D_2 provided that one of the following is done:

1. A more detailed evaluation of the seismic design category is made in accordance with the provisions and maps of the *International Building Code*. Buildings located in Seismic Design Category E in accordance with Table R301.2.2.1.1, but located in Seismic Design Category D in accordance with the *International Building Code*, shall be permitted to be designed using the Seismic Design Category D_2 requirements of this code.
2. Buildings located in Seismic Design Category E that conform to the following additional restrictions are permitted to be constructed in accordance with the provisions for Seismic Design Category D_2 of this code:
    2.1. All exterior shear wall lines or *braced wall panels* are in one plane vertically from the foundation to the uppermost *story*.
    2.2. Floors shall not cantilever past the *exterior walls*.
    2.3. The building is within the requirements of Section R301.2.2.2.5 for being considered as regular.

R301.2.2.2 Seismic Design Category C. Structures ~~assigned to Seismic Design Category C~~ located where the lateral designstrength coefficient is .15 shall conform to the requirements of this section.

Reason: Wood frame dwellings have always consistently performed safely (even if not well) in earthquakes for one simple reason:
"they are almost always built by carpenters who never talk to engineers."

The residential seismic provisions are beyond the comprehension and understanding of even, I'm sure, the people and committees who created them. It makes much more sense to tie the earthquake provisions to the potential magnitudes of the earthquakes that can (and will) occur.

SDCs do not realistically reflect the Magnitudes of earthquakes that may impact said "Detached one- and two-family dwellings," nor their associated real intensities of shaking (accelerations and velocities, including pga and pgv); (2) the contour seismic hazard-model maps, upon which the assigned SDCs are determined, are (a) numerical creations without physical reality; (b) mathematically flawed and incorrect (because a dimensionless number, the probability in one year, is arbitrarily assigned dimensional terms of "per yr." or annual frequency – leading to the improperly applied notion of a so-called earthquake "return period" as the basis on assigning earthquake design loads; and (c) non-stable between iterative cycles of creations (sometimes varying 25-30% between issues; and (d) SS or Spectral Response Acceleration is both confusing, misunderstood, and most certainly incorrectly interpreted or understood by all of the vast entities (state decision makers, code officials, design professionals, contractors and probably even the preponderance of ICC Committee members as well as Hearings attendees!

For example, see TAKE ME HOME SEISMIC LOADS

Cost Impact: Will increase the cost of construction
Perhaps . . . Will not increase the cost of construction

This proposal may or may not affect the cost of construction. This is (1) because detached one- and two-family dwellings must be already built to withstand the lateral forces due to wind; and (2) must include basements, "safe rooms"), or other afforded protections to protect occupants against the deadly impacts of hurricanes and tornadoes.

The point is; Detached one- and two-family need to consider the maximum Magnitude of realistic scenario earthquakes that they could, in fact, experience.
And not be constructed vulnerable to earthquakes, because a flawed numerical hazard model "guesses" incorrectly as to the likelihood or possibility of earthquakes. This should remain a rational and a scientific decision based upon protecting both public safety and property. A second point is that "cost" due to structural elements is almost always less than 80% of the cost of a building!

"In general, better seismic performance is achieved through increased lateral design forces (i.e., base shear), and detailing requirements that improve structural connection strength or structural member behavior in the inelastic range of response. Requirements for seismic bracing and anchorage of nonstructural components reduce potential for nonstructural damage and loss of building (or system) functionality."*

* viii, Executive Summary, NIST GCR 14-917-26
Cost Analyses and Benefit Studies for Earthquake-Resistant Construction in Memphis, Tennessee, 2013, 249 p.
NEHRP Consultants Joint Venture A partnership of the Applied Technology Council and the Consortium of Universities for Research in Earthquake Engineering.

In general, where costs might be increased, cost premiums above requirements for wind tend to fall within a range of +1-3%. For cases where seismic requirements would be now additional to what previous codes either applied/neglected/failed to enforce, estimates probably would fall within the range of 0.25 - 1%.

RB22-16 : R301.2.2-BELA13520

Public Hearing Results

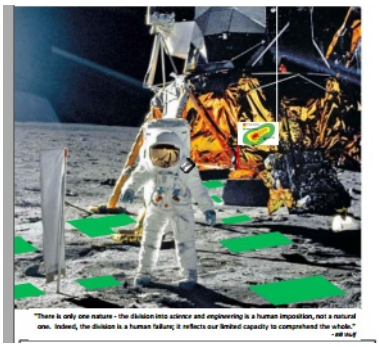
Committee Action: **Disapproved**

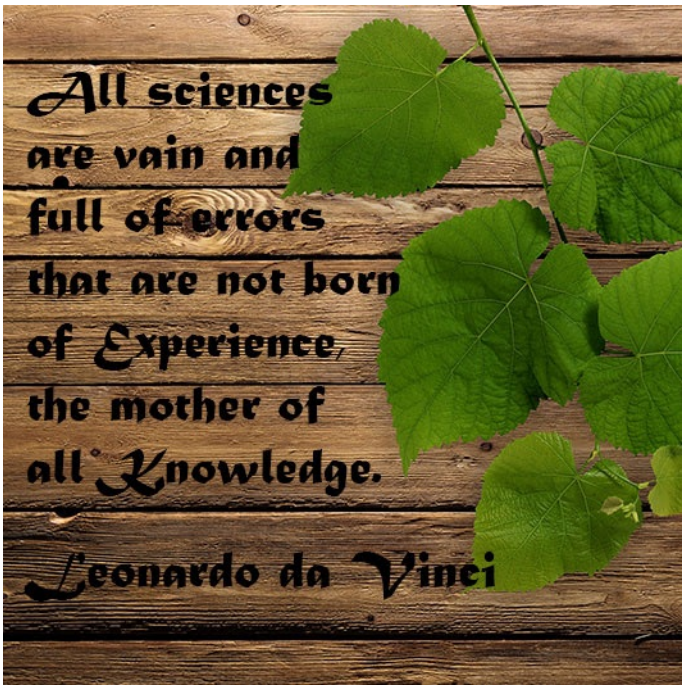
Committee Reason: There is no real substantiation for the statements in the proponent's reason. It is not clear what the proposal is intended to do. The reason statement indicates that some items should be deleted, but they are not deleted in the proposal. There are a number of other requirements in the code that point to seismic design categories and it is unclear what they should refer to if this proposal were approved.

Assembly Motion: **As Submitted**
Online Vote Results: **Failed**
Support: 10.92% (26) Oppose: 89.08% (212)
Assembly Action: **None**

Proponent : James Bela, representing Oregon Earthquakie Awareness (sasquake@gmail.com) requests Approve as Submitted.

Commenter's Reason: per RB22-16 and S118-16. Problems with present approach utilizing seismic design categories, which yo-yo up-and-down, have been discussed; and the systemic flaws in the underlying design values maps have also been well documented.





Bibliography: per RB 22-16 and S118-16

RB22-16

IRC: R702.1, R703.7, R703.7.1, R703.7.2, R703.7.3, R703.7.3.1 (New).

Proposed Change as Submitted

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

2015 International Residential Code

TABLE R702.1 (3)
CEMENT PLASTER PROPORTIONS, PARTS BY VOLUME

COAT	CEMENT PLASTER TYPE	CEMENTITIOUS MATERIALS				VOLUME OF AGGREGATE PER SUM OF SEPARATE VOLUMES OF CEMENTITIOUS MATERIALS[b]
		Portland Cement Type I, II or III or Blended Cement Type IP, I (PM), IS or I (SM)	Plastic Cement	Masonry Cement Type M, S or N	Lime	
First	Portland or blended	1			$^3/_4$ - $1^1/_2$[a]	$2^1/_2$ - 4
	Masonry			1		$2^1/_2$ - 4
	Plastic		1			$2^1/_2$ - 4
Second	Portland or blended	1			$^3/_4$ - $1^1/_2$	3 - 5
	Masonry			1		3 - 5
	Plastic		1			3 - 5
Finish	Portland or blended	1			~~$1^1/_2$ - 2~~ $^3/_4$ - 2[c]	$1^1/_2$ - 3
	Masonry			1		$1^1/_2$ - 3
	Plastic		1			$1^1/_2$ - 3

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. Lime by volume of 0 to $^3/_4$ shall be used where the plaster will be placed over low-absorption surfaces such as dense clay tile or brick.

b. The same or greater sand proportion shall be used in the second coat than used in the first coat.

c. Lime by volume of ¾ to 1½ shall be used where the plaster will be placed over low-absorption surfaces such as dense clay tile or brick.

R703.7 Exterior plaster (stucco). ~~Installation of these materials~~
Exterior plaster (stucco) shall be installed in ~~compliance~~ accordance with ASTM C 926, ASTM C 1063 and the provisions of this ~~code~~ section.

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C 1063. Expanded metal, welded wire or woven wire lath shall be attached into wood framing members with $1^1/_2$-inch-long (38 mm), 11 gage nails having a $^7/_{16}$-inch (11.1 mm) head, or $^7/_8$-inch-long (22.2 mm), 16 gage staples, spaced not more than ~~6~~ 7 inches (178 mm) on center vertically and not more than 24 inches ~~(152 mm)~~ on center horizontally, or as otherwise approved. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063

R703.7.2 Plaster. Plastering with portland cement plaster shall be in accordance with ASTM C 926. Cement materials shall be in accordance with ASTM C 91, ASTM C 150, ASTM C 595 or ASTM C 1328. Plaster shall be not less than three coats where applied over metal lath or wire lath and shall be not less than two coats where applied over masonry, concrete, pressure-preservative-treated wood or decay-resistant wood as specified in Section R317.1 or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in Table R702.1(1).

On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied to cover, but not extend below, lath, paper and screed.

The proportion of aggregate to cementitious materials shall be as set forth in Table R702.1(3).

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall ~~include~~ have a ~~water-resistive vapor-permeable barrier with a performance at least equivalent~~ water resistance equal to ~~two layers~~ or greater than that of 60-minute Grade D paper~~. The individual layers shall~~ and be ~~installed independently such that each~~ separated from the stucco by an intervening, substantially non water-absorbing layer ~~provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers~~ or designed drainage space.

~~Exception:~~ ~~Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.~~

Exception: In dry climate zones, the water-resistive barrier shall be vapor permeable and shll have a performance at least equivalent to two layers of 10-minute Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrer is directed between the layers.

R703.7.3.1 Furring. Furring between lath and vertical supports or solid sheating shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm) in nominal dimension, minimum ¾" metal channels, or self-furring lath manufactured to provide a minimum 1/4 inch space between the lath and the vertical suppor or sheathing. Furring shall be spaced a maximum of 24 inches on center horizontally and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Reason: The purpose of this code change is to correlate the requirements for exterior lath and plaster (stucco) with the requirements of ASTM C 926 and C 1063 and recommended practice. The code requirements in the IRC are not in alignment with the reference standards and lack key details needed to insure a good installation and minimize the risk of moisture intrusion.

In particular, the IRC lath attachment requirements state a 6" nail or staple spacing but do not specify direction or what nailing substrates are permitted. ASTM C 1063 specifies a 7" vertical spacing along and 16" to 24" horizontal spacing into wood studs. Without this clear direction in the code, some stucco is being installed with fasteners in a 6" grid pattern (both horizontal and vertical), leading to fasteners penetrating sheathing and providing a path for moisture intrusion behind the WRB and exterior sheathing and causing decay and water damage. The code user is referred to C 1063 for lath attachment requirements for other substrates, and is allowed to omit the lath when permitted by C 1063 for concrete substrates which have been properly prepared such that the plaster will bond directly to the concrete.

Also, the IRC does not include the requirement in C 1063 to provide furring behind expanded metal or wire lath except where such lath is self-furring, and that the furring shall create a minimum ¼" space between the lath and the vertical supports (framing, sheathing, or other vertical substrates). The furring requirement is added here using sizes consistent with other wood furring requirements in the IRC and the minimum channel size from C 1063. Again, the proposed language underscores that furring attachment to metal or wood framing must be into studs.

Significant water damage has occurred in stucco walls due to improper provisions for drainage and drying behind the lath and plaster. The minimum drainage space created by the furring requirements specified in C 1063 and included in this proposal allows for some drying of moisture which gets into the wall assembly, however if sufficient amounts of moisture accumulate, especially around penetrations and rough openings, it may be able to wick through the traditional 10-minute layers of Grade D paper. The larger drainage space associated with brick or natural-cut stone veneer would be necessary. Thus, the current exception for one layer of minimum 60-minute Grade D paper or equivalent, plus an additional non-absorbent layer (frequently an additional layer of 10-minute Grade D paper) or "designed" drainage space (using drainage mat, drainage board or other products) is elevated to the base practice. The existing requirement for 2 layers of 10-minute Grade D paper is retained as an exception for the dry climate zones.

Inconsistencies in Table R702.1(3) were also noted. For a first coat of masonry cement plaster, the "1" should appear under the Masonry Cement column, not the Lime column. The proportions of lime for a Portland cement finish coat are also revised to align with Table 3 of ASTM C926.

Significant water damage has occurred in stucco walls due to improper provision for drainage and drying behind the lath and plaster. A physical air space separation between the layers needs to be provided similar to the air space provided behind brick or natural cut stone veneers. Proper selection of a water-resistive barrier is also critical to good performance of a stucco wall assembly. The current exception for one layer of minimum 60-minute Grade D paper or equivalent is a good recommended practice and is elevated here to the base requirement. In wetter climates the possibility exists for bulk moisture to be present for extended periods of time between the layers, thus a requirement for an additional layer of 10-minute Grade D paper or equivalent is added.

Inconsistencies in Table R702.1(3) were also noted. For a first coat of masonry cement plaster, the "1" should appear under the Masonry Cement column, not the Lime column. The proportions of lime for a Portland cement finish coat are also revised to align with Table 3 of ASTM C926.

This proposal is submitted by the ICC Building Code Action Committee (BCAC). BCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2014 and 2015 the BCAC has held 5 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: **BCAC** (http://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/)

Cost Impact: Will increase the cost of construction

Depending on the products selected to meet the water-resistant barrier requirements, the cost to provide a single 60-minute layer may be greater than the cost to provide two separate 10-minute layers. In warm-humid climates, the requirement for an additional 10-minute layer over the 60-minute layer would be an increase in cost if not already being provided as the "substantially non-water absorbing layer".

RB295-16 : TABLE R703.7-KULIK11697

Public Hearing Results

Committee Action: **Approved as Modified**

Modification:

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C 1063. Expanded metal, welded wire or woven wire lath shall be attached into wood framing members with $1\,^{1}/_{2}$-inch-long (38 mm), 11 gage nails having a $^{7}/_{16}$-inch (11.1 mm) head, or $^{7}/_{8}$-inch-long (22.2 mm), 16 gage staples, spaced not more than 7 inches (178 mm) on center vertically and not more than 24 inches on center horizontally, or as otherwise approved. Fastening in the field shall be permitted. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall have a water resistance equal to or greater than that of 60-minute Grade D paper and be separated from the stucco a minimum distance of 3/8" by an intervening, substantially non water-absorbing layer or designed drainage space.

- **Exception:** In dry climate zones, the water-resistive barrier shall be vapor permeable and ~~shll~~ shall have a performance at least equivalent to two layers of 10-minute Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrer is directed between the layers.

R703.7.3.1 Furring. Furring between lath and vertical supports or solid sheating shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm) in nominal dimension, minimum ¾" metal channels, or ~~self-furring lath~~ approved material manufactured to provide a minimum ~~1~~ 3/~~4~~ 8 inch space between the lath and the vertical ~~suppor~~ support or the sheathing. Furring shall be spaced a maximum of 24 inches on center horizontally and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Committee Reason: This proposal provides a solution , as stated in the proponents published reason, to the area of significant problems as regards exterior lath and plaster. The modification allows fastening in the field and increases the separation distance of wood-based sheating from the stucco to 3/8 inch.

Assembly Motion: **Disapprove**

Online Vote Results: **Failed**

Support: 23.22% (49) Oppose: 76.78% (162)

Assembly Action: **None**

Online Floor Modification:

Public Comment 1:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz); Edward Kulik, representing Building Code Action Committee (bcac@iccsafe.org) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall have a water resistance equal to or greater than that of 60-minute Grade D paper and be separated from the stucco a minimum distance of $^{3}/_{8}$" by an intervening, substantially non water-absorbing layer or designed drainage space.

Exception: In dry climate zones, the water-resistive barrier shall ~~be vapor permeable and shll~~ have a performance at least equivalent to two layers of 10-minute Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrer is directed between the layers.

Commenter's Reason:

CRANDELL: It is recognized that RB295 makes a number of improvements to stucco provisions. However, a modification to make an important correction was attempted from the floor and also by the committee at the hearing and was not accepted by the chair for consideration. This public comment makes the necessary correction to prevent an exclusionary application of vapor permeable water-resistive barriers in dry climates, disallowing use of many other WRB materials that have worked well in commercial and residential construction. The concern in dry climates is not with the vapor permeance of the WRB but with the stucco mix design and curing practice for stucco when applied in dry climate conditions (over any permeability of substrate). Industry guidelines address these "dry climate" concerns and none of them indicate that exclusionary use of a vapor permeable WRB is necessary or appropriate. In fact, use of a vapor permeable WRB may add to the problem by increasing the loss of stucco hydration water during the curing of stucco, causing it to weaken. The exception statement needs to be corrected to remove this unjustified and exclusionary WRB spec.

KULIK: The purpose of this public comment is to remove the requirement that the 2 layers of 10-min grade D paper be vapor permeable. Concerns were raised at the Committee Action Hearings that this requirement may be contrary to good building science practice. In particular, if a dwelling is constructed in a warm or hot climate (even a dry one) and rainfall does occur, the resulting inward moisture drive could overpower a vapor-permeable material and infiltrate into the wall assembly.

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

Public Comment 2:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall have a water resistance equal to or greater than that of 60-minute Grade D paper and be separated from the stucco a minimum distance of $^{3}/_{8}$" by an intervening, substantially non water-absorbing layer or designed drainage space

~~Exception:~~ Exceptions:

1. In dry climate zones, the water-resistive barrier shall be vapor permeable and shll have a performance at least equivalent to two layers of 10-minute Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrer is directed between the layers.

2. A water-resistive barrier complying with Section R703.2 that has a maximum water vapor permeance of 10 perms and which is separated from the stucco by an intervening layer of 10-minute Grade D paper or other substantially non-water absorbing layer shall be permitted. Any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier shall be directed between the layers.

Commenter's Reason: While many improvements to stucco provisions are made in RB295, the changes made by RB295 to Section R703.7.3 are not complete and inadvertently remove an accepted and successful practice. Section R703.7.3 as revised by RB295 requires that a drainage space always be provided by stucco when a single layer of 60-min Grade D paper is used. This is appropriate for 60-min Grade D paper for improved moisture management performance, but is not universally appropriate or necessary for all alternatives to 60-min Grade D paper. Also, RB295 provides an exception for two layers of 10-min Grade D paper in dry climates, but this too is not universally appropriate for all alternatives to this stucco WRB method. Therefore, this PC adds an exception statement to recognize an accepted and successful WRB practice for managing moisture in conventional stucco walls. This builds on and does not detract from the improvements made in RB295 and is needed to avoid the inadvertent exclusion of what has been an accepted and succesful practice.

Public Comment 3:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3.1 Furring. Furring between lath and vertical supports or solid sheating shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm) in nominal dimension, minimum ¾" metal channels, or approved material manufactured to provide a minimum $^{3}/_{8}$ inch space between the lath and the vertical support or the sheathing. Furring shall be spaced a maximum of 24 inches on center horizontally and, where installed over wood or cold-formed steel framing, shall be fastened into framing members. Where installed over foam sheathing, furring connections shall comply with Sections R703.15, R703.16, or R703.17.

Commenter's Reason: This PC adds a needed reference for furring attachment requirements when furring is installed over foam sheathing and supports the weight of stucco cladding.

Public Comment 4:

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

Further Modify as Follows:

2015 International Residential Code

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C 1063. Expanded metal, welded wire or woven wire lath shall be attached into wood framing members with $1^{1}/_{2}$-inch-long (38 mm), 11 gage nails having a $^{7}/_{16}$-inch (11.1 mm) head, or $^{7}/_{8}$-inch-long (22.2 mm), 16 gage staples, spaced not more than 7 inches (178 mm) on center vertically and not more than 24 inches on center horizontally, or as otherwise approved. ~~Fastening in the field~~ Additional fastening between wood framing members shall be permitted. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063

Commenter's Reason: The purpose of this public comment is to clarify the intent of the floor modification approved at the Committee Action Hearings. The BCAC realized the added language allowing fasteners "in the field" was unclear. The intent is to permit a limited number of fasteners between framing members (i.e. directly to sheathing) for the purposes of tacking up sections of lath during installation and to prevent an entire installation from being disapproved at inspection because a handful of fasteners missed the stud.

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

Public Comment 5:

Proponent : John Woestman, representing Kellen Company, representing Extruded Polystyrene Foam Association (XPSA) (jwoestman@kellencompany.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall have a water resistance equal to or greater than that of 60-minute Grade D paper and be separated from the stucco a minimum distance of $^{3}/_{8}$" by an intervening, substantially non water-absorbing layer or designed drainage space.

- **~~Exception~~Exceptions:**

1. In dry climate zones, the water-resistive barrier shall be vapor permeable and shll have a performance at least equivalent to two layers of 10-minute Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrer is directed between the layers.
2. Foam sheathing complying with ASTM C578 or ASTM C1289 installed as a water resistive barrier in accordance with the manufacturer's approved installation instructions shall be permitted where separated from the stucco by an intervening layer of 10-minute Grade D paper or other substantially non-water absorbing layer. Any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier shall be directed between the layers.

Commenter's Reason: The changes made by RB295 to Section R703.7 are appropriate for water-resistive barriers like Grade D paper which have a high water vapor permeance such that drainage is important to prevent inward water vapor movement from stored moisture. However, these changes are not necessary for a material like foam sheathing when used as a WRB which protects underlying framing materials from inward water vapor movement. Foam sheathing materials complying with ASTM C578 and C1289 all have a maximum water vapor permeance below 10 perms and this is known to protect against inward moisture movement. In this case, the size of the drainage space becomes less important for successful performance although proper flashing is always important for all types and sizes of drainage spaces. To maintain this successful practice (which RB295 unnecessarily excludes as an option that is currently permitted in the code), this PC adds an exception statement with appropriate requirements.

RB295-16

RB298-16
IRC: R703.7.3.

Proposed Change as Submitted

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2015 International Residential Code

Revise as follows:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall ~~include a water-resistive vapor-permeable~~ comply with Section R703.7.3.1.

R703.7.3.1 Application over wood-based sheathing. Water-resistive barrier applications over wood-based sheathing shall comply with ~~a performance at least equivalent to two~~ one of the following materials and methods:

1. Two layers of Grade D paper~~. The individual layers shall be~~ installed independently such that each layer provides a separate continuous plane in accordance with Section R703.2 and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.
   - **Exception:** ~~Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.~~

2. One layer of 60-minute Grade D paper installed in accordance with Section 1404.2 and separated from the stucco by an intervening, substantially non-water-absorbing layer or drainage space with any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier directed between the layers or into the drainage space.

3. One layer of an approved water-resistive barrier material installed in accordance with the manufacturer's installation instructions with a water resistance equal to or greater than that of 60-minute Grade D paper. The approved water-resistive barrier material shall be separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space with any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier directed between the layers or into the drainage space.

Reason: This proposal improves enforceability and clarity of this section of code by clarifying general requirements (Section R703.7.3) and transparently distinguishing the three options for application with wood based sheathing (new Section R703.7.3.1). More importantly, the building science intent of the code is improved by removing an exclusionary and problematic specification of a "vapor permeable" water-resistive barrier (WRB). The exclusive specification of "vapor permeable" conflicts with the ability to use a vapor permeable or non-vapor permeable WRB when they are properly coordinated with the vapor retarder provisions in Section R702.7. For example, in warm/humid climates it is actually preferable to have a lower vapor permeance (non-vapor permeable) WRB on the exterior behind the stucco to mitigate excessive inward vapor drives and moisture movement. In cold climates, it also is possible to apply provisions of Section R702.7.1 (Class III vapor retarder) or Section R702.7 (Class I or II vapor retarder) with an appropriate amount of exterior continuous insulation to allow the use of a lower vapor permeance (non-vapor permeable) WRB. Thus, the code appropriately permits the use of vapor permeable and non-vapor permeable WRB materials when properly coordinated with the use of vapor retarders in Section R702.7.

Cost Impact: Will not increase the cost of construction
The proposal is primarily a clarification and provides more options for WRB specification without increasing cost.

RB298-16 :
R703.7.3-
CRANDELL12752

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal based on the proponents request and to be consistent with the prior action on RB295-16.

Assembly Action: **None**

Individual Consideration Agenda

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz) requests Approve as Submitted.

Commenter's Reason: The RB298 proposal was disapproved based on request of the proponent and action on RB295. However, several problems with Section R703.7.3 in RB295 have been identified since that time. This RB298 proposal provides clarification to Section R703.7.1 and also avoids the exclusionary and inappropriate WRB application and other concerns in RB 295 that are proposed for correction in separate public comments by this proponent. If those public comments on RB295 are approved, then this public comment may not be necessary and RB298 can remain disapproved without harm. However, if RB295 is not corrected, this proposal is compatible with RB295 and provides a needed alternative to changes made by RB295 in Section R703.7.3.

RB298-16

RB299-16
IRC: R703.7.3.

Proposed Change as Submitted

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2015 International Residential Code

Revise as follows:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

Exceptions:

~~**Exception:**~~ 1. Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

2. Where the water-resistive barrier is applied over vapor permeable or wood-based sheathing in Climate Zones 1A, 2A, 3A, 4A, 5A, and 4C in accordance with Section N1101.7, the water-resistive barrier material shall have a water vapor permeance of 10 perms or less in accordance with ASTM E96 (Method A) to minimize inward moisture movement. Alternatively, a ventilated air space shall be provided between the stucco and water-resistive barrier.

Reason: In many climates, having a vapor permeable WRB that is too vapor permeable (i.e., > 10 perms) can result in significant solar-driven inward moisture movement into and through exterior sheathing and farther into the wall assembly (e.g., to the interior vapor retarder or interior finishes), causing significantly increased risk of moisture damage or mold. This concern is particularly relevant to Section R703.7.3 which deals with conventional stucco -- a moisture storage ("reservoir") cladding. Consequently, a new exception #2 is provided to address this problem and is based on consistent findings and recommendations from several studies including Derome (2010), Wilkinson et al. (2007), BSC (2005), and Lepage and Lstiburek (2013). Key findings and recommendations from these studies also are summarized and applied in ABTG (2015). Finally, it is important to note that this proposal does NOT eliminate the use of WRB materials of greater than 10 perms in the stated application and climate zones because an alternative is provided to use a ventilated air space.

Bibliography: ABTG (2015). Assessment of Water Vapor Control Methods for Modern Insulated Light-Frame Wall Assemblies, Research Report No. ABTG-1410-03, Applied Building Technology Group, LLC, www.appliedbuildingtech.com/rr/1410-03

BSC (2005). Healthy and Affordable Housing: Practical Recommendations for Building, Renovating and Maintaining Housing, prepared for the U.S. Department of Housing and Urban Development and Building America Program of the U.S. Department of Energy, Building Science Corporation, www.buildingscience.com

Derome, D. (2010). The nature, significance and control of solar-driven water vapor diffusion in wall systems -- synthesis of Research Project RP-1235, ASHRAE Transactions, January 2010, www.ashrae.org

Lepage, R. and Lstiburek, J. (2013). Moisture Durability with Vapor-Permeable Insulating Sheathing, U.S. DOE, Building Technologies Office, www.osti.gov/bridge

Wilkinson, J., Ueno, K., DeRose, D., Straube, J.F., and Fugler, D. (2007). Understanding Vapour Permeance and Condensation in Wall Assemblies, 11th Canadian Conference on Building Science and Technology, Banff, Alberta, 2007.

Cost Impact: Will not increase the cost of construction

The proposal provides limitations on use that may affect some product choices under the specified conditions of use, but many material options of all types remain available and are unaffected by this proposal. In addition, provision for use of a ventilated air space would prevent any impact on WRB selection in the stated climate conditions.

RB299-16 :
R703.7.3-
CRANDELL12753

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on the committees prior action on RB295-16. This would create a conflict.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

- **Exceptions:**
-

1. Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.
2. Where the water-resistive barrier is applied over ~~vapor permeable or~~ wood-based sheathing in Climate Zones 1A, 2A, or 3A, ~~4A, 5A, and 4C in accordance with Section N1101.7, the water resistive barrier material shall have a water vapor permeance of 10 perms or less in accordance with ASTM E96 (Method A) to minimize inward moisture movement,. Alternatively,~~ a ventilated air space shall be provided between the stucco and water-resistive barrier.

Commenter's Reason: This public comment modifies RB299 to agree with a modification made to S302 by the structural committee in approving a similar proposal for the IBC. Thus, this public comment will coordinate improvements to the IBC with the IRC to address concerns with inward moisture movement in warm/moist climates. It also provides a means to correct problems with RB295 should they not be corrected by separate PC's provided for RB295. For information on the rationale and need for this proposal, refer to the reason statements for original proposals RB299 and S302.

RB299-16

RB300-16
IRC: R703.7.3.

Proposed Change as Submitted

Proponent : Laverne Dalgleish, Building Professionals, representing Building Professionals (ldalgleish@buildingprofessionals.com)

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer ~~or~~ , a designed drainage space or material complying with ASTM E2925.

Reference standards type: This reference standard is new to the ICC Code Books
Add new standard(s) as follows:
ASTM E2925 - 14 Standard Specification for Manufcactured Polymeric Drainage and Ventilation Materials used to Provide a Rainscreen Function

Reason: This allows another option for materials that meet a standard specification for materials that have been tested for allowing drainage and drying.

Cost Impact: Will not increase the cost of construction
This proposal simply add another option and as such does not add any cost to costruction

Analysis: A review of the standard(s) proposed for inclusion in the code,ASTM E 2925-14, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2016.

RB300-16 : R703.7.3-DALGLEISH13130

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal based on the proponents request and prior action on RB278-16 and RB279-16.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponent : Laverne Dalgleish, Building Professionals, representing Building Professionals (ldalgleish@buildingprofessionals.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

- **Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer, a designed drainage space or material complying with ASTM E2925.

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

Add new standard(s) as follows:

Commenter's Reason: The concern raised at the Group B Hearings was that the standard referenced (ASTM E2925) listed specific requirements for both the substrate and the water resistive barrier in the construction of the test specimen. This standard is currently being modified to make the requirements generic both for the substrate and for the water resistive barrier. The ASTM E2925 standard originally stated;

"A1.2.1 Construct one 1200 mm by 2400 mm test wall assembly comprised of 50 mm by 100 mm (nominal) perimeter framing and 50 mm by 100 mm (nominal) framing vertically at 400 mm on center. Install a wood panel of 11 mm oriented strand board (OSB) to the framing and fasten with 10d fasteners at 200 mm on center. Install a water resistive barrier (WRB) complying with Specification E2556/E2556M on the OSB in a seamless, continuous manner."

This will now state;

"A.1.2.1 The test specimen shall be 1200 mm by 2400 mm constructed from 50 mm by 100 mm (nominal) framing for the perimeter framing with two vertically studs every 400 mm on center across the 1200 mm leg, have a typical substrate used in building construction installed on one side of the wood framing which is then covered with a water resistive barrier (WRB) that it is seamless and continuous."

With the modified requirements in the standard, any substrate and any water resistive barrier is acceptable to be used in constructing the specimen.

Analysis: The proposed modification to this code change proposal includes update of the year edition of standard ASTM E2925 from -14 to -16. CP28, Section 3.6.3.1 and newly referenced standard "shall be completed and readily available prior to the Public Comment Hearing based on the cycle of code development which includes the code change proposal." Therefore, the proponent is required to provide information verifying that the standard ASTM E2925-16 is completed and readily available at the time of the public comment hearings.

RB300-16

RB301-16
IRC: R703.7.3.

Proposed Change as Submitted

Proponent : Laverne Dalgleish, Building Professionals, representing Building Professionals (ldalgleish@buildingprofessionals.com)

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance ~~at least equivalent~~ equal to ~~two layers~~ or greater than that of ~~Grade D paper~~ a *water-resistive barrier* complying with ASTM E2556, Type II. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than ~~that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.~~ ;

a. material complying with ASTM E 2556 Type 1 and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space or,

b. material complying with ASTM E2556 Type II and is seperated from stucco by a intervening material complying with ASTM E2925.

Reference standards type: This reference standard is new to the ICC Code Books
Add new standard(s) as follows:
ASTM E2925-14 Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials used to Provide a Rainscreen Function

Reason: This proposal provides another option in meeting the existing requirments of the code and references standards for materials selection

Cost Impact: Will not increase the cost of construction
As this simply provides another option, there is no additional cost

Analysis: A review of the standard(s) proposed for inclusion in the code,ASTM E 2925-14, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 1, 2016.

RB301-16 : R703.7.3-DALGLEISH13137

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal based on the proponents request and prior action on RB300-16 and RB295-16.

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponent : Laverne Dalgleish, representing Building Professionals (ldalgleish@buildingprofessionals.com) requests Approve as Modified by this Public Comment.

Modify as Follows:

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance equal to or greater than that of a *water-resistive barrier* complying with ASTM E2556, Type II. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

~~**Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than;~~

~~a. material complying with ASTM E 2556 Type 1 and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space or,~~

~~b. material complying with ASTM E2556 Type II and is seperated from stucco by a intervening material complying with ASTM E2925.~~

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minuit Grade D paper and is separated from stucco by an intervening substantially non-water-absorbing layer, a designated drainage space or material complying to ASTM E2925.

Reference standards type: This reference standard is new to the ICC Code Books
Add new standard(s) as follows:

Commenter's Reason: The concern raised at the Group B Hearings was that the standard referenced (ASTM E2925) listed specific requirements for both the substrate and the water resistive barrier in the construction of the test specimen. This standard is currently being modified to make the requirements generic both for the substrate and for the water resistive barrier. The ASTM E2925 standard originally stated;

"A1.2.1 Construct one 1200 mm by 2400 mm test wall assembly comprised of 50 mm by 100 mm (nominal) perimeter framing and 50 mm by 100 mm (nominal) framing vertically at 400 mm on center. Install a wood panel of 11 mm oriented strand board (OSB) to the framing and fasten with 10d fasteners at 200 mm on center. Install a water resistive barrier (WRB) complying with Specification E2556/E2556M on the OSB in a seamless, continuous manner."

This section will now state;

"A.1.2.1 The test specimen shall be 1200 mm by 2400 mm constructed from 50 mm by 100 mm (nominal) framing for the perimeter framing with two vertically studs every 400 mm on center across the 1200 mm leg, have a typical substrate used in building construction installed on one side of the wood framing which is then covered with a water resistive barrier (WRB) that it is seamless and continuous."

With the modified requirements in the standard, any substrate and any water resistive barrier is acceptable to be used in constructing the specimen.

Analysis: The proposed modification to this code change proposal includes update of the year edition of standard ASTM E2925 from -14 to -16. CP28, Section 3.6.3.1 and newly referenced standard "shall be completed and readily available prior to the Public Comment Hearing based on the cycle of code development which includes the code change proposal." Therefore, the proponent is required to provide information verifying that the standard ASTM E2925-16 is completed and readily available at the time of the public comment hearings.

RB301-16

RB302-16
IRC: R703.7.3.

Proposed Change as Submitted

Proponent : Theresa Weston, representing DuPont Building Innovations (theresa.a.weston@dupont.com)

2015 International Residential Code

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper, complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing (installed in accordance with Section R703.4) intended to drain to the water-resistive barrier is directed between the layers.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper, complying with ASTM E2556, Type II and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or designed drainage space.

Reference standards type: This is an update to reference standard(s) already in the ICC Code Books
Add new standard(s) as follows:
ASTM E2556-10 Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers intended for Mechanical Attachment

Reason: This proposal adds a reference standard specification to the Grade D Paper requirements, which are currently unspecified. Not only will this better define the existing requirements for Grade D Paper it will also provide more consistency between the codes, as IBC Section 2510.6 on stucco water-resistive barriers references ASTM E2556.

Cost Impact: Will not increase the cost of construction
This code does not change the requirements, only improves their definition.

RB302-16 :
R703.7.3-
WESTON13022

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: This proposal maintains the prescriptive minimum while adding a standard for product compliance.

Assembly Action: **None**

Individual Consideration Agenda

Proponent : Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz) requests Disapprove.

Commenter's Reason: This public comment requests disapproval for the same reason that similar proposals S304 and S305 were disapproved by the structural committee for the IBC. The ASTM E 2556 standard does not provide for equivalency of other WRB materials to Grade D paper. It has no upper limit on water vapor permeance consistent with Grade D paper and, thus, creates problems with inward moisture movement for materials that have higher permeance than Grade D paper (see reason statement with proposal RB299). ASTM E 2556 also includes no requirement for equivalency of installed water-resistance of substitutes or alternatives to Grade D paper. Several studies (see reason statement with proposal RB 286) have shown this to be a problem in assuring equivalency of other approved water-resistive barrier materials and this is particularly important in stucco applications. A similar proposal was denied at the last code development cycle for these same reasons and nothing has been done to make the necessary corrections.

Proponent : Danko Davidovic, representing Huber Engineered Woods LLC (danko.davidovic@huber.com) requests Disapprove.

Commenter's Reason: If this proposed amendment is approved, the performance characteristics of WRBs (regardless of the product type and manufacturing technology) will be governed by performance requirements for one specific type of product (flexible sheet mechanically attached WRBs). Considering the great variety of manufacturing technologies currently available

for WRBs, and possible development of promising future technologies, the current proposal may limit innovation in this arena. We propose further development of codes and standards that will result in more universal code language and not rely on specific product technology to define product performance requirements.

In addition, the original rationale of proponent to better define performance requirements of the Grade D papers by referencing to ASTM E2256 standard specification does not necessarily provide better definition of performance properties. For instance, specifying WRBs performance properties with regards to water vapor transmission characteristics using ASTM E96 desiccant method test results as required by ASTM E2556 appears to be obsolete and does not reflect the current building science knowledge about WRBs conditions in service. This requirement has been in place because of the materials historically used as WRB's including #15 felt and asphalt impregnated building paper. Under most circumstances and in most wall assemblies constructed in North America, the WRBs will be located directly beneath the cladding and most likely exhibit conditions very similar to outdoor ambient. Weather historic data for most North America locations reveal the monthly average relative humidity levels in 50-90 percent range. ASTM E96 Method B (Water Method) is the more appropriate performance requirement and better represents WRB in service conditions.

In general, we agree with intent to improve the code language to provide better specifications of performance characteristic of WRBs in service, however, we currently do not see proposed ASTM E2556 as an adequate alternative based on lack of technical accuracy and mismatch with the current building science knowledge. In addition, proposed change does not provide fair competitiveness among WRB products existing in the market today and may impact negatively new products developed by emerging technologies.

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Proponent : Joseph Lstiburek (joe@buildingscience.com) requests Disapprove.

Commenter's Reason: ASTM E2556 does not recognize the greater importance of the water method (wet cup) in wall assembly performance as compared to the desiccant method (dry cup). ASTM E2556 only lists the desiccant method in its Table 1 Requirements for Water Resistive Barriers. The current proposed language significantly limits the use of demonstrated alternative methods of water vapor transmission such as liquid applied water-resistive barriers, fully adhered sheet membranes and overlays and coatings applied directly to wood-based sheathings.

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