IBC - Structural

2022 GROUP B PUBLIC COMMENT AGENDA

SEPTEMBER 14 - 21, 2022
KENTUCKY INTERNATIONAL CONVENTION CENTER
LOUISVILLE, KY

INTERNATIONAL CODE COUNCIL®

2022 Public Comment Agenda

First Printing

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S3-22

IBC: 1502.5 (New)

Proposed Change as Submitted

Proponents: Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com)

2021 International Building Code

Add new text as follows:

1502.5 Waterproofing weather-exposed areas. Balconies, decks, landings, exterior stairways, occupied roofs, and similar surfaces exposed to the weather and sealed underneath shall be waterproofed and sloped a minimum of 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

Reason:
To ensure life-safety of users of balconies in cold climates, and to promote bulk water flow away from exterior walls or assemblies that adjoin balconies, so that ponding does not occur. Proper drainage on balconies, decks, etc., is an important performance requirement to aid in draining liquid water away from the building. In cold climates, any ponding that may occur could potentially freeze, causing a safety issue. Add the original code reference from 1997 UBC Chapter 14 under the roof drainage sections of IBC Chapter 15 (1502) and IRC Chapter 9 (R903.4). Section 1402.3 of the 1997 Uniform Building Code (UBC) stated:

1402.3 Waterproofing Weather-exposed Areas.

Balconies, landings, exterior stairways, occupied roofs, and similar surfaces exposed to the weather and sealed underneath shall be waterproofed and sloped a minimum of 1/4 unit vertical in 12 units horizontal (2% slope) for drainage.

Section 1402.3 of the 1997 Uniform Building Code (UBC) is what most waterproofing consultants considered the gold standard for ensuring that architects and builders constructed balcony and stairways with a minimum of 2% slope. The 2% slope requirement referenced in the Section 1402.3 of the 1997 UBC does not exist at any location within any version of IBC from 2000 through 2018. Decks were also listed as an area that should be waterproofed and sloped.

During the transition from the UBC to the IBC, this valuable and useful reference to require a minimum 2% surface slope for balconies, landings, and exterior stairways was omitted from the IBC and IRC. There are no referenced statements or definitions anywhere in the current codes on this issue.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This should be standard practice, thus will not impact the cost of construction.

S3-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved at the request of the proponent to determine the proper location for these requirements within the code. A committee member also expressed concern over the terminology "sealed underneath". (Vote: 14-0)

S3-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1410 (New), 1410.1 (New)

Proponents: Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com) requests As Modified by Public Comment

Replace as follows:

2021 International Building Code

1410
Drainage of weather-exposed areas

1410.1 Drainage of weather-exposed areas. Where the surface of balconies, decks, landings, porches, stairways, and similar surfaces are exposed to weather, and do not have spaces nor gaps or are not perforated to drain, they shall be sloped to drain.

Commenter's Reason: The concept of this code change, as well as the companion code change RB-257, were generally supported by the committees. However, they expressed concern related to a few items, all of which have been addressed in this public comment. The items addressed are:

1. Moves the location of this code change from the roofing chapter (15) to a new section in chapter 14. Chapter 14 seemed the most-logical place for this new code requirement since there is not a chapter on “walls” and there is a precedent for non-roof, horizontal element requirements in section 1409, plastic composite decking.

2. Changes the title of the section to reflect the intent of the code change, which is to ensure that any surfaces that are exposed to weather are sloped to drain. However, removes specific slope requirements that may cause a conflict between existing landing and stair slope requirements.

3. Clarifies that this requirement only applies in cases where surfaces are not perforated nor slotted.

4. Removes requirement for waterproofing and the vague term “sealed underneath,” which were also concerns raised by the concrete industry related to sealing slabs on both sides.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This should be standard practice.

Public Comment# 3146

S10-22

IBC: 1504.7 (New), 1504.6, MCA (New), (New)

Proposed Change as Submitted

Proponents: Bob Zabcik, representing Metal Construction Association (bob@ztech-consulting.com); Andy Williams, representing National Frame Building Association (panelcladsolutions@gmail.com)

2021 International Building Code

Add new text as follows:

1504.7 Metal edge systems for metal roofs. Metal edge systems, excluding gutters, installed on metal roofs shall be designed and installed for wind *loads* in accordance with Chapter 16 and tested for resistance in accordance with ANSI/MCA FTS-1.

> **Exception:** Direct-fastened edge systems without cleats as defined in ANSI/MCA FTS-1 which are connected to cold-formed steel or aluminum cladding or framing are permitted to be designed for resistance to wind *loads* in accordance with the applicable referenced structural design standard in Section 2210.1 and 2002.1 as applicable.

Revise as follows:

1504.6 Edge systems for built-up, modified bitumen and single-ply low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roofsystems having a slope less than 2 units vertical in 12 units horizontal (2:12) shall be designed and installed for wind *loads* in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design *wind speed*, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable.

Add new standard(s) as follows:

MCA

Metal Construction Assocation
8735 W. Higgins Rd., Suite 300
Chicago, IL 60631

ANSI/MCA FTS-1-2019. Test Method for Wind Load Resistance of Flashings Used with Metal Roof System

Reason: This proposal adds requirements for testing of edge metal systems on metal roofs, similar to those currently in place for low-slope built-up, modified bitumen and single-ply roof systems in Section 1504.6. It is being put forth by the Metal Construction Association (MCA) to address issues observed by the Roofing Industry Committee on Weather Issues (RICOWI) through their Windstorm Investigation Program (WIP). The test standard cited, ANSI/MCA FTS-1-2019, was developed by MCA through the Single Ply Roofing Institute's (SPRI) ANSI-accredited canvassing process. MCA is a sponsoring organization of RICOWI and began development of ANSI/MCA FTS-1 in 2016 to address this issue and the method was finalized and released in 2019. The standard may be found at <https://tinyurl.com/ytemy7u4> and a video of a test may be viewed at <https://tinyurl.com/y36heu49>.
The RICOWI WIP post-event field studies revealed instances where the edge metal system was torn from the perimeter of a building with a metal roof, exposing a longer leading edge of the incorporated roof panel and initiating a partial failure of the roof system, particularly near the corners and gable edges of the roof. Although the damage was very localized, it did allow water to enter the building and in some cases, the edge metal became a wind-borne debris threat. Most commonly, this occurred in two cases:

1) Where a multi-piece edge trim assembly incorporating cleats deformed enough to disengage the cleat.

2) Where the metal edge trim assembly was fastened to a non-metal substrate such as wood or masonry, leaving to question the appropriateness of the fastener used since it would often not be provided by the edge system manufacturer for non-metal substrates.

The exception in Section 1504.7 recognizes that neither of the two conditions listed applies to non-cleated, single-piece edge systems attached to structural metal roof or wall panels and framing, provided the fastening is appropriately designed in accordance with the relevant design standards. (i.e, the fastener and substrate material requirements and fastener spacing criteria of these standards are met.) These standards are AISI S100 for cold-formed steel and AA ADM for aluminum. See Figures 1 through 4 in the attachment or at <https://tinyurl.com/2p8msj2t>, which visually differentiate these conditions.

Additional text is also being added to the title of Section 1504.6 to provide delineation between the sections. However, this does not alter the requirements for built-up, modified bitumen and single-ply roof systems in any way.

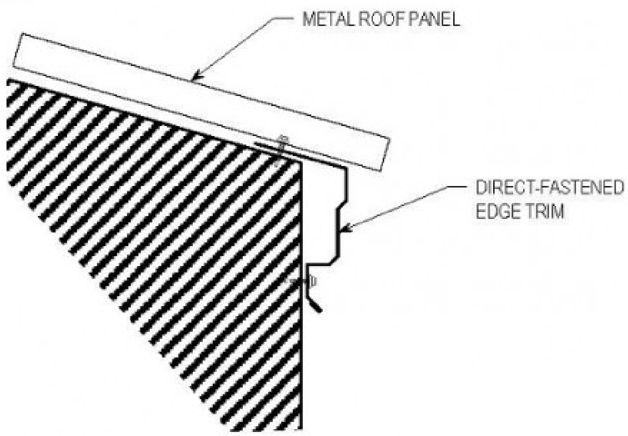


Figure 1: Direct-Fastened, Non-Cleated Eave Edge System

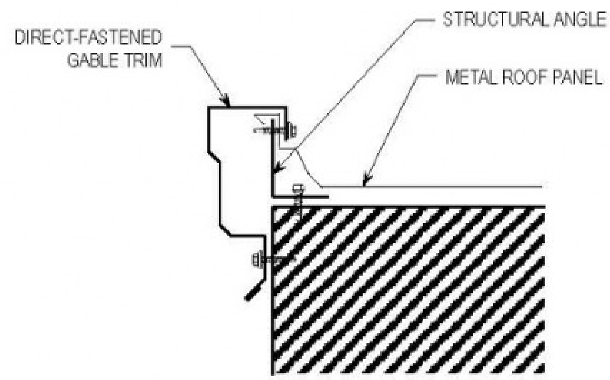


Figure 3: Direct-Fastened, Non-Cleated Gable Edge System

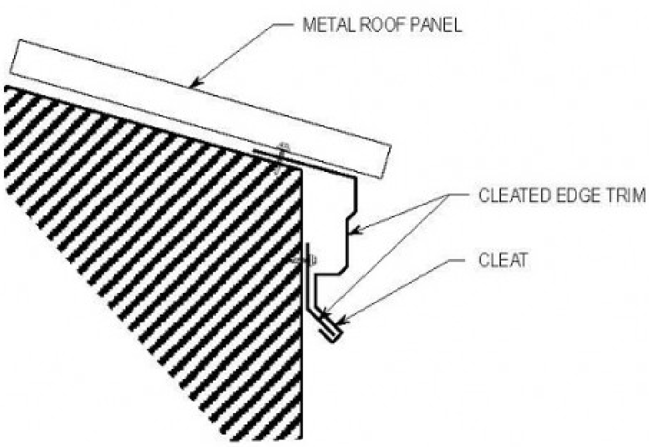


Figure 2: Cleated Eave Edge System

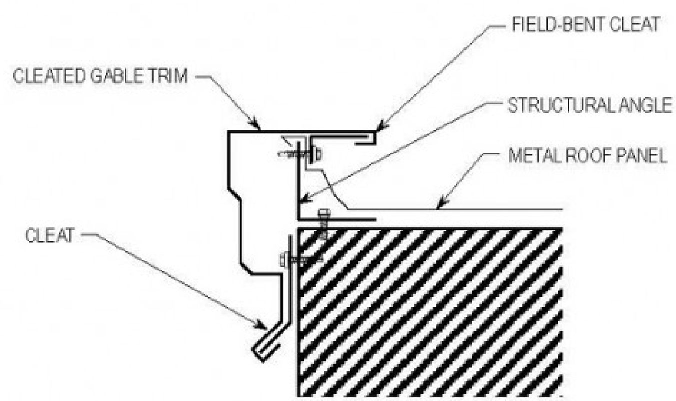


Figure 4: Cleated Gable Edge System

Cost Impact: The code change proposal will increase the cost of construction
This change would indirectly increase the cost of construction as the cost of the testing would presumably be passed to the consumer. However, the impact is tiny. The test cost is estimated to be $1,500/test and most manufacturers carry 2-5 styles of edge metal systems different enough to test separately. Thus, total cost is estimated to be $3,000 to $7,500. If this cost is accrued over the life of the product line, assumed to be 500 to 10,000 buildings, it results in a nominal increase of at most $15 per building. If a typical building includes 400 feet of trim valued at $5/lineal foot, this represents a nominal increase of 0.8% for the trim system. The cost of the edge metal is at most 1% of the total building cost, making the increase at most 0.008% over the entire building.

S10-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposed new standard does not address all metal roof systems. (Vote: 14-0)

S10-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1504.7

Proponents: Bob Zabcik, representing Metal Construction Association (bob@ztech-consulting.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1504.7 Metal edge systems for metal panel roofs. Metal edge systems, ~~excluding gutters~~ except gutters and counterflashing, installed on ~~metal roofs~~ structural metal panel roofs or metal panel roofs applied to a solid or closely fitted deck shall be designed and installed for wind *loads* in accordance with Chapter 16 and tested for resistance in accordance with ANSI/MCA FTS-1.

> **Exception:** Direct-fastened edge systems without cleats as defined in ANSI/MCA FTS-1 which are connected to cold-formed steel or aluminum cladding or framing are permitted to be designed for resistance to wind *loads* in accordance with the applicable referenced structural design standard in Section 2210.1 and 2002.1 ~~as applicable~~.

Commenter's Reason: This comment makes changes to the original proposal addressing objections raised during CAH testimony and is being submitted by the proponent. The proposed modifications directly exclude counterflashing and replace the term "metal roofs" with language already used in Sections 1504.3.1 and 1504.3.2 describing the specific systems to which the proposed requirements apply, clarifying that shingles are excluded from the requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This is a clarification of the proposal, and the original cost statement still applies.

Public Comment# 3148

S24-22 Part II

Proposed Change as Submitted

Proponents: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com)

2021 International Residential Code

Revise as follows:

R905.1.1Underlayment. *Underlayment* in accordance with this section is required for asphalt shingles, clay and concrete tile, *metal roof shingles*, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, *metal roof panels* and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869, ~~and~~ D6757, and D8257 shall bear a *label* indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table 905.1.1(2). *Underlayment* shall be ~~attached~~ fastened in accordance with Table R905.1.1(3).

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

1. ~~As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance with ASTM D1970 and installed in accordance with both the *underlayment* manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.~~
2. ~~As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane bearing a *label* indicating compliance with ASTM D1970, installed in accordance with the *manufacturer's installation instructions* for the deck material, shall be applied over all joints in the roof decking. An *approved underlayment* complying with Table R905.1.1(1) for the applicable roof covering~~

Exception: Structural metal panels that do not require a substrate or underlayment.

TABLE R905.1.1(1) UNDERLAYMENT TYPES

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM D8257 ASTM D1970	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV ASTM D8257 ASTM D1970
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type I	ASTM D226 Type II

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		ASTM D6380 Class M mineral-surfaced roll roofing	
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757 <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D4869 Type III or ~~Type~~ IV <u>ASTM D8257</u> <u>ASTM D1970</u>

For SI: 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(2) UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a ~~19-inch~~ strip of underlayment ~~felt~~ <u>that is half the width of a full sheet</u> parallel to and starting at the eaves, <u>fastened sufficiently to hold in place</u>. Starting at the eave, apply ~~36-inch-wide~~ <u>full</u>	Underlayment shall be one of the following: <u>1. Two</u> ~~two~~ layers <u>of mechanically fastened underlayment</u> applied in the following manner: ~~apply~~ <u>Apply</u> a ~~19-inch~~ strip of underlayment ~~felt~~ <u>that is half the width of a full sheet</u> parallel to and starting at the eaves, <u>fastened sufficiently to hold in place.</u> Starting at the eave, apply ~~36-inch-wide~~ <u>full width</u> sheets of underlayment,

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		width sheets of underlayment, overlapping successive sheet shalf the width of a full sheet plus 2 inches ~~19 inches.~~ Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. Additionally, a single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Clay and concrete tile	R905.3	For roof slopes from $2^1/_2$ units vertical in 12 units horizontal ($2^1/_2$:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a ~~19-inch~~ strip of underlayment ~~felt~~ that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply ~~36-inch-wide~~ full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from	Underlayment shall be one of the following: 1. Two ~~two~~ layers of mechanically fastened underlayment applied in the following manner: ~~apply~~ Apply a ~~19-inch~~ strip of underlayment ~~felt~~ that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply ~~36-inch-wide~~ full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		the eave and lapped 2 inches. End laps shall be 4 inches and shall be offset by 6 feet. Additionally, a single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Metal roof shingles	R905.4	Apply in accordance with the manufacturer's installation instructions.	Underlayment shall be one of the following: 1. Two ~~two~~ layers of mechanically fastened underlayment applied in the following manner: ~~apply~~ Apply a ~~19-inch~~ strip of underlayment ~~felt~~ that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply ~~36-inch-wide~~ full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Photovoltaic shingles	R905.16	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a ~~19-inch~~ strip of underlayment ~~felt~~ that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply ~~36-inch-wide~~ full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. Additionally, a single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	Underlayment shall be one of the following: 1. Two ~~two~~ layers of mechanically fastened underlayment applied in the following manner: ~~apply~~ Apply a ~~19-inch~~ strip of underlayment ~~felt~~ that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply ~~36-inch-wide~~ full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches ~~19 inches~~. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.

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

TABLE R905.1.1(3) UNDERLAYMENT ~~APPLICATION~~ ATTACHMENT

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	~~The~~ Mechanically fastened underlayment shall be ~~attached~~ fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing. Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Clay and concrete tile	R905.3		
Photovoltaic shingles	R905.16		
Metal roof shingles	R905.4	Manufacturer's installation instructions.	~~The~~ Mechanically fastened underlayment shall be ~~attached~~ fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing. Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering. **Exception:** Self-adhering polymer modified bitumen underlayment shall not be installed under wood shakes or wood shingles.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

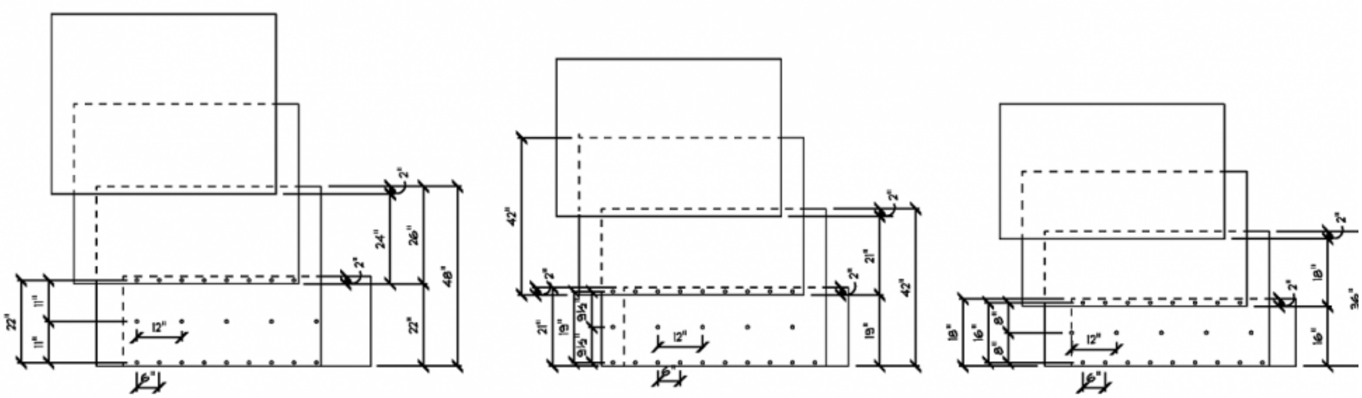
For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

Add new standard(s) as follows:

ASTM

<u>D8257/D8257M-20</u> — <u>Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing</u>

Reason: The first language modification in this proposal is to stipulate that underlayment is required. I receive feedback regularly from contractors that while the existing language implies that underlayment is required, that requirement is not clearly stated. Additionally, this proposal adds the first ever consensus-based Standard that is applicable to synthetic/polymeric underlayments. The roofing industry has been in need of such a Standard for many years so that this category of products can be adequately evaluated for performance. This proposal also modifies the language that is applicable to installation of a 2-layer underlayment system (See below Fig. clarifying the Underlayment Lapping and Fastening) in such a way that it reduces waste (the current language results in a strip of underlayment that is too narrow to be used in most cases), and so that the lapping and fastening requirements are applicable to any width of underlayment. Finally, this proposal also adds an exception in the charging paragraph for consistency with current IBC language, and also includes some cleanup items for clarity and consistency.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds a new ASTM Standard for qualifying synthetic underlayments which have been in use for many years and clarifies and reorganizes existing requirements.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM D8257/D8257M-20 Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

<u>Public Hearing Results</u>

Committee Action: **Disapproved**

Committee Reason: The committee decided that the proposed text is confusing, especially in the column for areas where wind design is not required in accordance with figure R301.2.1.1, which could be misunderstood as requiring another layer. Therefore, the committee asked the proponent to clarify the language in the public comment phase (Vote: 8-1).

Individual Consideration Agenda

Public Comment 1:

IRC: R905.1.1, TABLE R905.1.1(1), TABLE R905.1.1(2), TABLE R905.1.1(3)

Proponents: Gregory Keeler, representing Owens Corning (greg.keeler@owenscorning.com) requests As Modified by Public Comment

Modify as follows:

2021 International Residential Code

R905.1.1Underlayment. *Underlayment* in accordance with this section is required for asphalt shingles, clay and concrete tile, *metal roof shingles*, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, *metal roof panels* and *photovoltaic shingles* shall conform to the applicable standards listed in this chapter. *Underlayment* materials required to comply with ASTM D226, D1970, D4869, D6757, ~~and~~ <u>or</u> D8257 shall bear a *label* indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). *Underlayment* shall be applied in accordance with Table R905.1.1(2). *Underlayment* shall be fastened in accordance with Table R905.1.1(3).

Exception: Structural metal panels that do not require a substrate or underlayment.

TABLE R905.1.1(1) UNDERLAYMENT TYPES

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM D8257 ASTM D1970	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D8257 ASTM D1970
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing <u>ASTM D8257</u> <u>ASTM D1970</u>	ASTM D226 Type II <u>ASTM D8257</u> <u>ASTM D1970</u>
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D8257 ASTM D1970	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D8257 ASTM D1970

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D8257 ASTM D1970	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D8257 ASTM D1970
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM D8257 ASTM D1970	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D8257 ASTM D1970
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ~~ASTM D8257~~ ~~ASTM D1970~~	ASTM D226 Type II ASTM D4869 Type III or IV ~~ASTM D8257~~ ~~ASTM D1970~~
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ~~ASTM D8257~~ ~~ASTM D1970~~	ASTM D226 Type II ASTM D4869 Type III or IV ~~ASTM D8257~~ ~~ASTM D1970~~
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or IV ASTM D8257 ASTM D1970
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM D8257 ASTM D1970	ASTM D4869 Type III or IV ASTM D8257 ASTM D1970

For SI: 1 mile per hour = 0.447 m/s.

TABLE R905.1.1(2) UNDERLAYMENT APPLICATION

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	Underlayment shall be one of the following: 1. For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches Distortions in the underlayment shall not interfere with the ability of the shingles to seal.	Underlayment shall be one of the following: 1. Two layers of mechanically fastened underlayment applied in the following manner: Apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches . Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		End laps shall be 4 inches and shall be offset by 6 feet. 2. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 3. ~~Additionally, a~~ A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Clay and concrete tile	R905.3	Underlayment shall be one of the following: 1. For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall	Underlayment shall be one of the following: 1. Two layers of mechanically fastened underlayment applied in the following manner: Apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches . End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips.

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 3. ~~Additionally, a~~ A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Metal roof shingles	R905.4	Apply in accordance with the manufacturer's installation instructions.	Underlayment shall be one of the following: 1. Two layers of mechanically fastened underlayment applied in the following manner: Apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches . End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		
Photovoltaic shingles	R905.16	Underlayment shall be one of the following: 1. For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4	Underlayment shall be one of the following: 1. Two layers of mechanically fastened underlayment applied in the following

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
		units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 3. ~~Additionally, a~~ A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.	manner: Apply a strip of underlayment that is half the width of a full sheet parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply full width sheets of underlayment, overlapping successive sheets half the width of a full sheet plus 2 inches . Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. 2. A minimum 4 inch wide strip of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering shall be applied over the entire roof over the 4 inch wide membrane strips. 3. A single layer of self-adhering polymer modified bitumen underlayment complying with ASTM D1970, installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.

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

TABLE R905.1.1(3) UNDERLAYMENT ATTACHMENT

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	Mechnically fastened underlayment shall be fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have
Clay and concrete tile	R905.3		
Photovoltaic shingles	R905.16		

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
			a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch into the roof sheathing.Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Metal roof shingles	R905.4	Manufacturer's installation instructions.	Mechnically fastened underlayment shall be fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch into the roof sheathing.Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering. **Exception:** Self-adhering polymer modified bitumen underlayment shall not be installed under wood shakes or wood shingles.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

Commenter's Reason: This modification satisfies concerns from several industry stakeholders and harmonizes the contents of Section R905.1 with the language that was approved as modified in Proposal S24-22 Part I for the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and comment merely provide clarification of the underlayment requirements and adds a new ASTM Standard that applies exclusively to synthetic underlayments.

TABLE R905.1.1(3) UNDERLAYMENT ATTACHMENT

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	Mechnically fastened underlayment shall be fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^{3}/_{4}$ inch into the roof sheathing.Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering.
Clay and concrete tile	R905.3		
Photovoltaic shingles	R905.16		
Metal roof shingles	R905.4	Manufacturer's installation instructions.	Mechnically fastened underlayment shall be fastened with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^{3}/_{4}$ inch into the roof sheathing.Self-adhering polymer modified bitumen underlayment shall be installed in accordance with the underlayment and roof covering manufacturer's installation instructions for the deck material, roof ventilation configuration, and climate exposure of the roof covering. **Exception:** Self-adhering polymer modified bitumen underlayment shall not be installed under wood shakes or wood shingles.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

Commenter's Reason: This modification satisfies concerns from several industry stakeholders and harmonizes the contents of Section R905.1 with the language that was approved as modified in Proposal S24-22 Part I for the IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and comment merely provide clarification of the underlayment requirements and adds a new ASTM Standard that applies exclusively to synthetic underlayments.

Public Comment# 3280

S28-22

IBC: 1507.4.3, TABLE 1507.4.3(1), TABLE 1507.4.3(2), 1507.5.5

Proposed Change as Submitted

Proponents: Mark Graham, representing National Roofing Contractors Assoc. (mgraham@nrca.net)

2021 International Building Code

Revise as follows:

1507.4.3 Material standards. Metal-sheet *roof covering* systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet *roof coverings* installed over structural decking shall comply with Table 1507.4.3~~(1)~~. ~~The materials used for metal-sheet *roof coverings* shall be naturally corrosion resistant or provided with *corrosion resistance* in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).~~

TABLE 1507.4.3~~(1)~~ METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
5% Aluminum alloy-coated steel	ASTM A875, GF60
Aluminum	ASTM B209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-coated steel	ASTM A463, T2 65
Aluminum-zinc alloy coated steel	ASTM A792 AZ 50
Cold-rolled copper	ASTM B370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz./sq. ft. for preformed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A653 G-90 zinc-coated[a].
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B101
Prepainted steel	ASTM A755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A240, 300 Series Alloys
Steel	ASTM A924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m^2, 1 pound per square foot = 4.882 kg/m^2, 1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A653 galvanized steel roofing shall be G-60.

~~TABLE 1507.4.3(2) MINIMUM CORROSION RESISTANCE~~

55% ~~Aluminum-zinc alloy coated steel~~	~~ASTM A792 AZ 50~~
~~5% Aluminum alloy-coated steel~~	~~ASTM A875 GF60~~
~~Aluminum-coated steel~~	~~ASTM A463 T2 65~~
~~Galvanized steel~~	~~ASTM A653 G-90~~
~~Prepainted steel~~	~~ASTM A755 [a]~~

a. ~~Paint systems in accordance with ASTM A755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A463, ASTM A653, ASTM A792 or ASTM A875.~~

1507.5.5 Material standards. *Metal roof shingle roof coverings* shall comply with Table 1507.4.3~~(1)~~. ~~The materials used for metal-roof shingle *roof coverings* shall be naturally corrosion resistant or provided with *corrosion resistance* in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).~~

Reason: This code change is intended to clarify code's requirements regarding metal sheet stock used in fabricating metal roof panels and metal roof shingles.
This proposal combines existing Table 1507.4.3(1) and Table 1507.4.3(2) into a single new table, Table 1507.4.3. ASTM A792 AZ 50; ASTM G653 G90 and ASTM A755 currently occur in both tables. From existing Table 1507.4.3(2), ASTM A857 GF 60 and A463 T2 65 do not occur in Table 1507.4.3(1), so they these standards are being added to the new consolidated table.

From existing Table 1507.4.3(2), Footnote "a" is deleted. ASTM A463, ASTM A653, ASTM A792 and ASTM A875 are already incorporated into ASTM A755 and, therefore, these standards and this footnote are not necessary in the code.

There are no changes in code's technical requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is simply a clarification of existing provisions. There are no changes in code's technical requirements.

S28-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal cleans up the language and removes redundancies. (Vote: 14-0)

S28-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1507.4.3, TABLE 1507.4.3

Proponents: Mark Graham, representing National Roofing Contractors Association (mgraham@nrca.net) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1507.4.3 Material standards. Metal-sheet *roof covering* systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet *roof coverings* ~~installed over structural decking~~ shall comply with Table 1507.4.3.

TABLE 1507.4.3 METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
5% Aluminum alloy-coated steel	ASTM A875, GF60
Aluminum	ASTM B209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-coated steel	ASTM A463, T2 65
55% ~~A~~ aluminum-zinc alloy coated steel	ASTM A792 AZ 50
Cold-rolled copper	ASTM B370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz./sq. ft. for preformed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A653 G-90 zinc-coated[a].
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B101
Prepainted steel	ASTM A755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A240, 300 Series Alloys
Steel	ASTM A924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m^2, 1 pound per square foot = 4.882 kg/m^2, 1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A653 galvanized steel roofing shall be G-60.

Commenter's Reason: This code change proposal was Approved As Submitted by a 14-0 committee vote. In the committee's reasoning, they cited "...the proposal cleans up the language and removes redundancies."
After review of my code change proposal, two additional editorial changes are suggested for further clarity.

- Strike "...installed over structural decking..." as these material standards are intended to apply to both metal-sheet roof coverings installed over open structural framing and metal-sheet roof coverings installed over solid or closely-fitted decking.
- Add "55%" to the label for aluminum-zinc alloy coated steel for consistency with the current Table 1507.4.3(1) and Table 1507.4.3(2).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This code change proposal and this public comment are a clarification to the code's existing requirements and have no cost impact.

Public Comment# 3472

Public Comment 2:

IBC: 1507.4.3, TABLE 1507.4.3

Proponents: Vincent Sagan, Thomas Associates, Inc., representing Metal Building Manufacturers Association (MBMA) (vsagan@thomasamc.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1507.4.3 Material standards. Metal-sheet *roof covering* systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet *roof coverings* ~~installed over structural decking~~ shall comply with Table 1507.4.3.

TABLE 1507.4.3 METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
5% Aluminum alloy-coated steel	ASTM A875, GF60
Aluminum	ASTM B209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-coated steel	ASTM A463, T2 65
55% Aluminum-zinc alloy coated steel	ASTM A792 AZ 50
Cold-rolled copper	ASTM B370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz./sq. ft. for preformed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A653 G-90 zinc-coated[a].
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B101
Prepainted steel	ASTM A755[b]
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A240, 300 Series Alloys
Steel	ASTM A924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m^2, 1 pound per square foot = 4.882 kg/m^2, 1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A653 galvanized steel roofing shall be G-60.

b. Paint systems in accordance with ASTM A755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A463, ASTM A653, ASTM A792 or ASTM A875.

Commenter's Reason: This public comment eliminates an unintended exception and adds information that was inadvertently eliminated in the original proposed change.

1. Section 1507.4.3 includes the phrase, “installed over structural decking”, which could make structural metal roofing, common in metal buildings, exempt from this requirement. Note that the section for metal roof shingle roof coverings, Section 1507.5.5, does not include a similar phrase. It states, “Metal roof shingle roof covering shall comply with Table 1507.4.3.” Deleting “installed over structural decking” would make both sections similar and not create an unintended exception.
2. Table 1507.4.3(2) included a footnote that was not included in the original proposed change. This should be added to Table 1507.4.3. If not added, the removal would eliminate a current requirement.
3. Table 1507.4.3(2) included in its description of the ASTM A792 AZ 50 material, 55%. This is not present in Table 1507.4.3. 55% should be added in front of aluminum-zinc alloy coated steel in the unified table because A792 only covers 55%.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost impact of the original proposed change did not increase or decrease the cost of construction; it was a clarification of the existing provisions. This public comment eliminates an unintended exception and adds information that was inadvertently eliminated in the original proposed change.

Public Comment# 3143

S30-22

IBC: 1507.8.1

Proposed Change as Submitted

Proponents: Chadwick Collins, representing Cedar Shake & Shingle Bureau (ccollins@kellencompany.com)

2021 International Building Code

Revise as follows:

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center or greater, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. When wood shingles are installed over spaced sheathing and the underside of the shingles are exposed to the attic space, the attic shall be ventilated in accordance with Section 1202.2. The shingles shall not be backed with materials that prevent the free movement of air on the interior side of the spaced sheathing.

Reason: When shingles are installed over spaced sheathing, the underlayment is interwoven as the installation progresses. Due to this configuration, moisture can reach the underlayment. While much of the drying of the underlayment occurs in the direction of the exterior, some of the drying process occurs toward the interior. The exposure of this surface (the backside of the shingles and underlayment) to the ventilation space is necessary to facilitate this process. This language is proposed to ensure this configuration is maintained and not compromised with the installation of other building components, such as spray foam insulation, that would otherwise occupy this air space and eliminate this process. Further, installation of components such as spray foam insulation also eliminates one surface for shingles to release heat gained through exposure. This slows the release of heat energy, requiring the shingle to hold on to heat load for longer durations, which leads to shorter service life cycles

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not add any requirements to current construction practices, but clarifies the configuration of the installation.

S30-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted consistent with the IRC code committee actions. (Vote: 13-1)

S30-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1507.8.1

Proponents: Chadwick Collins, representing Cedar Shake & Shingle Bureau (ccollins@kellencompany.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center or greater, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. When wood shingles are installed over spaced sheathing and the underside of the shingles are exposed to the attic space, the attic shall be ventilated in accordance with Section 1202.2. The shingles shall not be backed with materials that will occupy the required air gap space and prevent the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: The original proposal was recommended for approval by the Committee as submitted (14-0), but the Committee members did advise CSSB to address the last sentence to clarify that the ventilated space, or air gap space, needs to remain. This public comment modification is the attempt to fulfill that request of the Committee to further clarify that the air gap is first, required as stated in the previous sentence, and second, to remain as an air space.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not add any requirements to current construction practices, but clarifies the configuration of the installation and the public comment modification provides further clarity to installation practices.

Public Comment# 3514

S32-22

IBC: 1507.9.1

Proposed Change as Submitted

Proponents: Chadwick Collins, representing Cedar Shake & Shingle Bureau (ccollins@kellencompany.com)

2021 International Building Code

Revise as follows:

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. Where wood shakes are installed over spaced sheathing and the underside of the shakes are exposed to the attic space, the attic shall be ventilated in accordance with Section 1202.2. The shakes shall not be backed with materials that prevent the free movement of air on the interior side of the spaced sheathing.

Reason: When shakes are installed over spaced sheathing, the underlayment is interwoven as the installation progresses. Due to this configuration, moisture can reach the underlayment. While much of the drying of the underlayment occurs in the direction of the exterior, some of the drying process occurs toward the interior. The exposure of this surface (the backside of the shakes and underlayment) to the ventilation space is necessary to facilitate this process. This language is proposed to ensure this configuration is maintained and not compromised with the installation of other building components, such as spray foam insulation, that would otherwise occupy this air space and eliminate this process. Further, installation of components such as spray foam insulation also eliminates one surface for shakes to release heat gained through exposure. This slows the release of heat energy, requiring the shakes to hold on to heat load for longer durations, which leads to shorter service life cycles

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not add any requirements to current construction practices, but clarifies the configuration of the installation.

S32-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted consistent with the committee action on S30-22. (Vote: 14-0)

S32-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1507.9.1

Proponents: Chadwick Collins, representing Cedar Shake & Shingle Bureau (ccollins@kellencompany.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards. Where wood shakes are installed over spaced sheathing and the underside of the shakes are exposed to the attic space, the attic shall be ventilated in accordance with Section 1202.2. The shakes shall not be backed with materials that will occupy the required air gap space and prevent the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: The original proposal was recommended for approval by the Committee as submitted (14-0), but the Committee members did advise CSSB to address the last sentence to clarify that the ventilated space, or air gap space, needs to remain. This public comment modification is the attempt to fulfill that request of the Committee to further clarify that the air gap is first, required as stated in the previous sentence, and second, to remain as an air space.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not add any requirements to current construction practices, but clarifies the configuration of the installation and the public comment modification provides further clarity to installation practices.

Public Comment# 3516

S34-22

IBC: 1507.14, 1507.14.1, 1507.14.2, 1507.14.3 (New), 1507.14.4 (New)

Proposed Change as Submitted

Proponents: Chadwick Collins, representing Roof Coating Manufacturers Association (RCMA) (ccollins@kellencompany.com)

2021 International Building Code

1507.14 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.14.1 Slope. Liquid-applied roofing shall have a design slope of not less than $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope).

1507.14.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957 or ASTM D3468.

Add new text as follows:

1507.14.3 Application. Liquid-applied roofing shall be installed in accordance with the manufacturer's installation instructions.

1507.14.4 Flashings. Flashings shall be applied in accordance section 1507.14 and the liquid-applied roofing manufacturer's installation instructions.

Reason: This proposal provides clarity and direction that is missing from section 1507.14 regarding application and flashings that other sections within 1507 currently have for those respective materials. The manufacturer's installation instructions have the specifics for each specific product and should be the source material to consult for proper application and flashing guidance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal updates 1507.14 to mimic the format and content of sister subsections of 1507 to be consistent.

S34-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as it does not provide any additional requirements. The requirement for being applied in accordance with the manufacturer's installation instructions is already covered elsewhere in the IBC. The reference in the proposed section 1507.14.4 to section 1507.14 creates a circular reference. (Vote: 14-0)

S34-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1507.14, 1507.14.1, 1507.14.2, 1507.14.3, 1507.14.4

Proponents: Chadwick Collins, representing Roof Coating Manufacturers Association (RCMA) (ccollins@kellencompany.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1507.14 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.14.1 Slope. Liquid-applied roofing shall have a design slope of not less than $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope).

1507.14.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957 or ASTM D3468.

1507.14.3 Application. Liquid-applied roofing shall be installed in accordance with this chapter and the manufacturer's installation instructions.

~~**1507.14.4 Flashings.** Flashings shall be applied in accordance section 1507.14 and the liquid-applied roofing manufacturer's installation instructions.~~

Commenter's Reason: From the Committee's feedback, RCMA recognizes the charging flashing language at the beginning of Chapter 15 and has struck the flashing paragraph from the original proposal. RCMA also reviewed the other references in chapter 15 related to application for other materials and has added language to be more alike to those instances for consistency.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment and the original proposal is meant to provide clearer guidance on current applications and will not impact cost of installation.

Public Comment# 3522

S39-22

IBC: SECTION 1510 (New), SECTION 202 (New), 1510.1 (New), 1510.2 (New), 1510.3 (New), 1510.4 (New), 1510.4.1 (New)

Proposed Change as Submitted

Proponents: Chadwick Collins, representing Protected Membrane Roofing Institute (ccollins@kellencompany.com)

2021 International Building Code

Add new text as follows:

SECTION 1510
PROTECTED MEMBRANE ROOF ASSEMBLIES

Add new definition as follows:

PROTECTED MEMBRANE ROOF ASSEMBLY. A roof assembly of interacting components designed to waterproof a building's top surface where insulation is installed above the roof membrane and outside of the air barrier.

Add new text as follows:

1510.1 General. A *protected membrane roof assembly* shall comply with the applicable requirements of this Chapter.

1510.2 Landscaped roofs and vegetative roofs. *Landscaped roofs* and *vegetative roofs* that include *protected membrane roof assemblies* shall comply with Sections 1505.10 and 1507.15.

1510.3 Foam plastics. Foam plastic insulation in *protected membrane roof assemblies* shall comply with the applicable requirements of Chapter 26.

1510.4 Installation. *Protected membrane roof assemblies* shall be installed in accordance with the manufacturer's installation instructions.

1510.4.1 Flashing. Flashing for *protected membrane roof assemblies* shall be installed in accordance with this Section and the manufacturers installation instructions.

Reason: The current IBC presumes that foam plastic insulation in roofing assemblies is installed within the assembly and below the membrane. That installation is common with many roof covering types, including single-ply, EPDM, and other roofing materials. For example, section 1508.1 includes a reference to above-deck foam plastic insulation being installed below an approved roof covering.
There are many applications of low-slope systems where some or all of the above-deck insulation is installed above the roof covering membrane. These systems are known as Protected Membrane Roofs and are commonly used for vegetative and landscaped roofs.

The proposal adds a new Section to address this growing segment of the roofing market by establishing the minimum standards specific to this use. It also adds a definition for the assembly to clarify when this proposed section would apply. The new section includes basic provisions for installation, flashing, and foam plastic installation requirements. Additionally, it provides pointers to the appropriate provisions for vegetative and landscaped roofs. It should be noted that proposal F15-21 modified definitions for vegetative roofing and landscaped roofs by making careful distinctions between a vegetative roof system, and a landscaped roof- meaning a roof that has landscaping elements above but not part of the roof assembly. This proposal completes the work done last year by including protected membrane roofs in the IBC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal would provide additional roofing options in the code, and help streamline product approval. The use of protected membrane roofing is not mandatory thus adds no new requirements.

S39-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as there are more items which need to be considered to make a complete proposal. The committee noted that the proposed definition utilizes inconsistent terminology. The proposal does not provide new requirements. (Vote: 14-0)

S39-22

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 1510, SECTION 202, 1510.1, 1510.1.1 (New), 1510.1.2 (New), 1510.1.3 (New), 1510.2, 1510.3, 1510.4, 1510.4.1

Proponents: Chadwick Collins, representing Protected Membrane Roofing Institute (ccollins@kellencompany.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

SECTION 1510
PROTECTED MEMBRANE ROOF ASSEMBLIES

PROTECTED MEMBRANE ROOF ASSEMBLY. A roof assembly ~~of interacting components~~ designed to waterproof a building's top surface where insulation is installed above the roof membrane ~~and outside of the air barrier~~.

1510.1 General. A *protected membrane roof assembly* shall comply with the applicable requirements of this Chapter.

1510.1.1 Wind resistance of mechanically attached or adhered roof membranes. Roof membranes that are mechanically attached or adhered to the *roof deck* shall be designed to resist the design wind *load* pressures for components and cladding in accordance with Section 1609.5.2. The wind *load* on the roof membrane shall be permitted to be determined using *allowable stress design*. These roof membranes shall be tested in accordance with FM 4474, UL 580, or UL 1897.

1510.1.2 Wind resistance of ballasted roof membranes. Roof membranes that are ballasted shall be designed in accordance with ANSI/SPRI RP-4.

1510.1.3 Wind resistance of components above the roof membrane. Components installed above the roof membrane in *protected membrane roof assemblies* shall be designed to resist the design wind *load* pressures for components and cladding in accordance with Section 1609.5.2. The wind *load* on the components above the roof membrane shall be permitted to be determined using *allowable stress design*. These components shall be designed in accordance with ANSI/SPRI RP-4.

1510.2 Landscaped roofs and vegetative roofs. *Landscaped roofs* and *vegetative roofs* that include *protected membrane roof assemblies* shall comply with Sections 1505.10 and 1507.15.

1510.3 Foam plastics. Foam plastic insulation in *protected membrane roof assemblies* shall comply with the applicable requirements of Chapter 26.

1510.4 Installation. *Protected membrane roof assemblies* shall be installed in accordance with the manufacturer's installation instructions.

1510.4.1 Flashing. Flashing for *protected membrane roof assemblies* shall be installed in accordance with this Section and the manufacturers installation instructions.

Commenter's Reason: This proposed modification addresses multiple items raised at the Committee Action Hearings. First, the definition is modified to match a proposed floor mod (Searer1) that the proponent supported in testimony. Next, opponents expressed agreement in concept, but that the lack of wind resistance details outlining guidance for implementation led to opposition testimony. In response, wind requirement language for protected membranes and the components above the protected membranes have been added. At the committee's guidance, these modifications are submitted to address these concern which were cited as the reason for recommended disapproval.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed modifications to the original proposal does not change the cost of the installation of such assemblies. The original cost impact statement for the original proposal remains valid.

Public Comment# 3215

S42-22

IBC: SECTION 1511 (New), 1511.1 (New), 1511.1.1 (New), 1511.1.2 (New), 1511.1.3 (New), 1511.1.4 (New)

Proposed Change as Submitted

Proponents: Bill McHugh, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

2021 International Building Code

Add new text as follows:

SECTION 1511
AIR BARRIERS

1511.1 General. A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. Air Barrier construction shall comply with the *International Building Code*, *International Energy Conservation Code*, and shall comply with Sections 1511.1.1 through 1511.1.4.

Exception: Air barriers are not required in buildings located in *Climate Zone* 2B as referenced in the *International Energy Conservation Code.*

1511.1.1 Construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.10. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

1511.1.2 Continuous air barrier. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.

   Exception: Buildings in *Climate Zones* 2B, 3C and 5C.

2. Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.

   Exceptions:

   1. Buildings in *Climate Zones* 2B, 3B, 3C and 5C.
   2. Buildings larger than 5,000 square feet (464.5 m^2) floor area in *Climate Zones* 0B, 1, 2A, 4B and 4C.
   3. Buildings between 5,000 square feet (464.5 m^2) and 50,000 square feet (4645 m^2) floor area in *Climate Zones* 0A, 3A and 5B.

3. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.

1511.1.3 Materials. Materials with an air permeability not greater than 0.004 cfm/ft^2 (0.02 L/s × m^2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $^3/_8$ inch (10 mm).
2. Oriented strand board having a thickness of not less than $^3/_8$ inch (10 mm).

3. Extruded polystyrene insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m^3) and having a thickness of not less than $1^1/_2$ inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than $4^1/_2$ inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12.7 mm).
8. Cement board having a thickness of not less than $^1/_2$ inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. Single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $^5/_8$ inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

1511.1.4 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft^2 (0.2 L/s × m^2) under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677 , ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 of the International Energy Conservation Code are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
3. A Portland cement/sand parge, stucco or plaster not less than $^1/_2$ inch (12.7 mm) in thickness

Reason: Air Barrier requirements appeared in The 2012 International Energy Conservation Code. While air barriers are required in great detail in the IECC, there is nowhere in the International Building Code that covers details for building these assembles. In the IBC, there are chapters for plastics, where insulation is regulated. Roofing materials are regulated in Chapter 15. After a search of the 2021 IBC, it was found that air barrier is mentioned once, in Chapter 12, and not in the context of an air barrier found in the IECC.
The building envelope covers the whole building, and all that's encompassed in the assemblies. There are thermal, moisture and fire requirements, penetrations and breaches made for joints, all that have to be accounted for in air barrier design. Having air barriers in the same code as the rest of the building requirements means consistency and better built buildings.

In order to build air barriers to protect the building elements - and their interaction with other requirements, the air barrier sections belong duplicated in the International Building Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since air barriers are already required by the International Energy Conservation Code, this proposal will not increase the cost of construction, nor will it decrease. It is the hope that the air barrier will be built with all the other complexities of buildings referenced in the same code, the IBC.

Staff Analysis: These provisions are duplicated from the 2021 International Energy Conservation Code.

S42-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal is a repeat of the IECC and only addresses commercial buildings while saying nothing about residential buildings. Air barriers are a whole building requirement. Some materials listed may not have a manufacturer's installation instruction. (Vote: 14-0)

S42-22

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 1511, 1511.1, 1511.1.1, 1511.1.2, 1511.1.3, 1511.1.4

Proponents: Bill McHugh, representing Chicago Roofing Contractors Association (bill@mc-hugh.us) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

SECTION 1511
AIR BARRIERS

1511.1 General. ~~A~~ Where a continuous air barrier ~~shall be~~ is provided throughout the building thermal envelope ,~~. The~~ the continuous air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. Air Barrier construction shall comply with the *International Building Code, International Energy Conservation Code*, and shall comply with Sections 1511.1.1 through 1511.1.4.

~~**Exception:** Air barriers are not required in buildings located in *Climate Zone* 2B as referenced in the *International Energy Conservation Code.*~~

1511.1.1 Construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.10. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

~~**1511.1.2 Continuous air barrier.** A continuous air barrier for the opaque building envelope shall comply with the following~~:

~~1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.~~

   ~~**Exception:** Buildings in *Climate Zones* 2B, 3C and 5C.~~

2. ~~Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.~~

   ~~**Exceptions:**~~

   ~~1. Buildings in *Climate Zones* 2B, 3B, 3C and 5C.~~
   ~~2. Buildings larger than 5,000 square feet (464.5 m^2) floor area in *Climate Zones* 0B, 1, 2A, 4B and 4C.~~
   ~~3. Buildings between 5,000 square feet (464.5 m^2) and 50,000 square feet (4645 m^2) floor area in *Climate Zones* 0A, 3A and 5B.~~

3. ~~Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.~~

1511.1.3 Materials. Materials with an air permeability not greater than 0.004 cfm/ft^2 (0.02 L/s × m^2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $^3/_8$ inch (10 mm).

2. Oriented strand board having a thickness of not less than $^3/_8$ inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m^3) and having a thickness of not less than 1$^1/_2$ inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4$^1/_2$ inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12.7 mm).
8. Cement board having a thickness of not less than $^1/_2$ inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. Single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $^5/_8$ inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

1511.1.4 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft^2 (0.2 L/s × m^2) under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 of the International Energy Conservation Code are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
3. A Portland cement/sand parge, stucco or plaster not less than $^1/_2$ inch (12.7 mm) in thickness

Commenter's Reason: The International Energy Conservation Code (IECC) has required a continuous air barrier since the 2012 version of the code. However, there is no corresponding section in the International Building Code (IBC) that covers air barrier construction and regulation for wind, fire, physical properties.
The reason for placing this section on air barrier in Chapter 15 is for material consistency. The generic deemed to comply list in the IECC is comprised of items such as single ply, modified bitumen, liquid applied materials, sprayed polyurethane foam, insulations, gypsum boards, that are all included in Chapter 15 of the IBC. Over half the items in the deemed to comply list are covered in Chapter 15 of the IBC with many material specifications, and requirements specified in Chapter 15. The rest are items such as pre-cast concrete, concrete block, plaster or other items, that are non-combustible.

In addition, I agree with the committee's comment that the requirement for a continuous air barrier belongs in the IECC. To that end, the language that invokes the air barrier requirements has been removed from this section. The language that states when an air barrier is required should stay in the IECC, as the committee rightly stated.

The air leakage protection that is provided by a continuous air barrier provides value to the owner. The air barrier needs to be regulated in the IBC after it has been mandated by the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Since this requirement is already in the IECC, it will not increase or decrease the cost of construction.

Public Comment# 3333

Public Comment 2:

IBC: SECTION 1511, 1511.1, 1511.1.1, 1511.1.2, 1511.1.3, 1511.1.4

Proponents: Theresa Weston, representing Air Barrier Association of America (ABAA) (holtweston88@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

SECTION 1511
AIR BARRIERS

1511.1 General. Where a ~~A~~ continuous air barrier ~~shall be~~ is provided throughout the building thermal envelope , ~~. The continuous air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof.~~ the Air Barrier construction shall comply with the ~~*International Building Code,*~~ *International Energy Conservation Code*, and ~~shall comply with~~ Section~~s~~ 1511.1.1 ~~through 1511.1.4.~~

> ~~**Exception:** Air barriers are not required in buildings located in *Climate Zone* 2B as referenced in the *International Energy Conservation Code.*~~

1511.1.1 Construction. In order to reduce the potential for the accumulation of water within the roof assembly, where a roof covering is used as part of the continuous air barrier for the building thermal envelope, the following junctions and intersections shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location.

1. Open breaches made for penetrations of the roof deck that allow air between the roof deck and roof membrane used as an air barrier.
2. Open breaches made for expansion or voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated or non-rated floor or floor/ceiling assemblies that allow air between the roof deck and roof membrane used as an air barrier.
3. Seams of the roof deck.

~~The continuous air barrier shall be constructed to comply with the following:~~

1. ~~The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.~~
2. ~~Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.~~
3. ~~Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.~~
4. ~~Recessed lighting fixtures shall comply with Section C402.5.10. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.~~

~~**1511.1.2 Continuous air barrier.**~~ A continuous air barrier for the opaque building envelope shall comply with the following:

1. ~~Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.~~

   ~~**Exception:** Buildings in *Climate Zones* 2B, 3C and 5C.~~

2. ~~Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.~~

   ~~**Exceptions:**~~

   1. ~~Buildings in *Climate Zones* 2B, 3B, 3C and 5C.~~
   2. ~~Buildings larger than 5,000 square feet (464.5 m^2) floor area in *Climate Zones* 0B, 1, 2A, 4B and 4C.~~
   3. ~~Buildings between 5,000 square feet (464.5 m^2) and 50,000 square feet (4645 m^2) floor area in *Climate Zones* 0A, 3A and 5B.~~

3. ~~Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.~~

~~**1511.1.3 Materials.** Materials with an air permeability not greater than 0.004 cfm/ft^2 (0.02 L/s × m^2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's~~

~~instructions.~~

1. ~~Plywood with a thickness of not less than $^3/_8$ inch (10 mm).~~
2. ~~Oriented strand board having a thickness of not less than $^3/_8$ inch (10 mm).~~
3. ~~Extruded polystyrene insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).~~
4. ~~Foil-back polyisocyanurate insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).~~
5. ~~Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m^3) and having a thickness of not less than 1$^1/_2$ inches (38 mm).~~
6. ~~Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4$^1/_2$ inches (113 mm).~~
7. ~~Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12.7 mm).~~
8. ~~Cement board having a thickness of not less than $^1/_2$ inch (12.7 mm).~~
9. ~~Built-up roofing membrane.~~
10. ~~Modified bituminous roof membrane.~~
11. ~~Single-ply roof membrane.~~
12. ~~A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $^5/_8$ inch (15.9 mm).~~
13. ~~Cast-in-place and precast concrete.~~
14. ~~Fully grouted concrete block masonry.~~
15. ~~Sheet steel or aluminum.~~
16. ~~Solid or hollow masonry constructed of clay or shale masonry units.~~

~~**1511.1.4 Assemblies.** Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft^2 (0.2 L/s × m^2) under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677 , ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 of the International Energy Conservation Code are met.~~

1. ~~Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.~~
2. ~~Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.~~
3. ~~A Portland cement/sand parge, stucco or plaster not less than $^1/_2$ inch (12.7 mm) in thickness~~

Commenter's Reason: This public comment recognizes that requirements for roof construction which utilize air barriers are needed in the IBC. This public comment modification deletes the proposed sections which were repetitive of those in the IECC and references the IECC instead. It does include moisture/water durability related requirements that are not included in the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not include any new air barrier requirements, but rather includes only methods of proper construction of air barriers in a roof assembly when an air barrier is being used.

Public Comment# 3354

S43-22

IBC: [BG] 1511.7, 1511.7.6 (New), 1511.7.6.1 (New)

Proposed Change as Submitted

Proponents: Amanda Hickman, representing Single-Ply Roofing Industry (SPRI) (amanda@thehickmangroup.com)

2021 International Building Code

Revise as follows:

[BG] 1511.7 Other rooftop structures. *Rooftop structures* not regulated by Sections 1511.2 through 1511.6 shall comply with Sections 1511.7.1 through 1511.7.~~5~~ 6, as applicable.

Add new text as follows:

1511.7.6 Lightning Protection Systems. Lightning protection system components shall be installed in accordance with Section 1511.7.6.1. Lightning protection systems shall not be attached directly to metal edge systems, including gutters, where these roof assembly components are required to be tested to ANSI/SPRI/FM 4435-ES-1 or ANSI/SPRI GT-1 in accordance with Sections 1504.6 or 1504.6.1.

Exception: Where permitted by the manufacturer's installation instructions for the metal edge systems or gutters.

1511.7.6.1 Installation. Lightning protection system components directly attached to or through the roof covering shall be installed in accordance with this chapter and the roof covering manufacturer's installation instructions. Flashing shall be installed in accordance with the roof assembly manufacturer's installation instructions and Sections 1503.2 and 1507 where the lightning protection system installation results in a penetration through the roof plane.

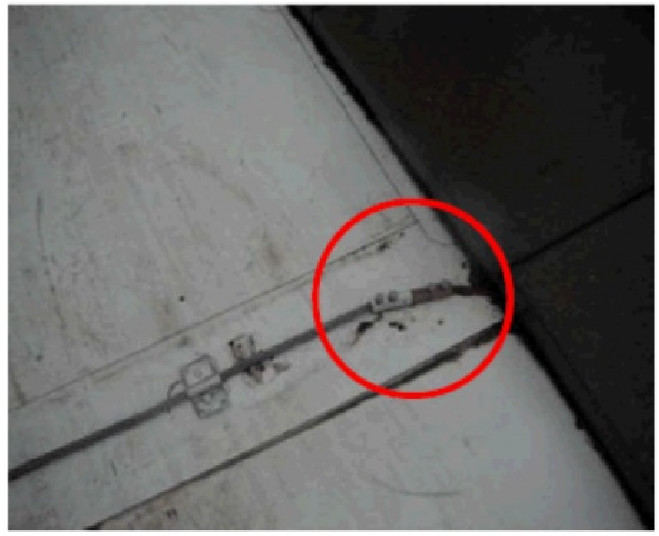
Reason: Progress was made during the Group A cycle to include Lightning Protection Systems (LPS) and their appropriate installation standards in the IBC (G176-21). However, these standards (NFPA 780 and UL 96A) are currently silent on the impact the attachment of LPS have on the roof. In order to preserve the building envelope in a wind or weather event, it is critical to maintain the integrity of the roof components which are required by code to be tested and to ensure weatherproofing continuity.

Even in moderate wind events, there have been documented failures of code compliant and tested roof assembly components where LPS were attached.

Roof assembly components such as coping and gutters are required by code to be tested to specific wind loads. LPS attachments to these roof component systems not only alter the wind load on of these tested components, but also alter their performance by restricting thermal movement causing galvanic reaction, leak point, etc.

This proposal clarifies that attachment of LPS to any part of the roof needs to be done in accordance with the installation instructions for the roof assembly, roof covering, metal edge systems, or gutter. Where LPS components attach to or penetrate the roof, they must be properly flashed. Reasonable and readily available methods and details exist to attach LPS systems independent of coping, fascia, gutter and roof assembly components and for flashing of existing LPS attachment methods where penetrations are required. This proposal clarifies that regardless of sequencing challenges which may exist in new or retrofit applications of LPS, the integrity of tested components and the envelope shall be maintained.

Due to the installation of the Lightning Protection System components there may be certain details which require additional hot air welded patches installed under cable splices, frayed cable, and specific connections that could abrade the membrane. Hot air welded patches will provide sufficient protection to the field membrane from abrasion. Pictures below show examples of areas where additional hot air welded patches would be required.



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

This proposal just clarifies that LPS must be installed in accordance with the roofing component manufacturer's installation instructions. Flashing is already required for penetrations. There will, however, be a reduction in failure costs.

S43-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as adding an exception for the attachment is inappropriate. The committee stressed that the proposal needs additional coordination between disciplines. (Vote: 13-1)

S43-22

Individual Consideration Agenda

Public Comment 1:

IBC: [BG] 1511.7, 1511.7.6, 1511.7.6.1, 1511.7.6.2 (New)

Proponents: Amanda Hickman, representing Single-Ply Roofing Industry (SPRI) (amanda@thehickmangroup.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

[BG] 1511.7 Other rooftop structures. *Rooftop structures* not regulated by Sections 1511.2 through 1511.6 shall comply with Sections 1511.7.1 through 1511.7.6 .2, as applicable.

1511.7.6 Lightning Protection Systems. Lightning protection system components shall be installed in accordance with Sections 1511.7.6.1 , 1511.7.6.2 and 2703 of this code. ~~Lightning protection systems shall not be attached directly to metal edge systems, including gutters, where these roof assembly components are required to be tested to ANSI/SPRI/FM 4435-ES-1 or ANSI/SPRI GT-1 in accordance with Sections 1504.6 or 1504.6.1.~~

1511.7.6.1 Installation on metal edge systems or gutters. Lightning protection system components ~~directly~~ attached to ANSI/SPRI/FM 4435/ES-1 or ANSI/SPRI GT-1 tested metal edge systems or gutters shall be installed with compatible brackets, fasteners, or adhesives, in accordance with the metal edge systems or gutter manufacturer's installation instructions. When metal edge system or gutter manufacturer is unknown, installation shall be as directed by a registered design professional.~~or through the roof covering shall be installed in accordance with this chapter and the roof covering manufacturer's installation instructions. Flashing shall be installed in accordance with the roof assembly manufacturer's installation instructions and Sections 1503.2 and 1507 where the lightning protection system installation results in a penetration through the roof plane.~~

1511.7.6.2 Installation on roof coverings. Lightning protection system components directly attached to or through the roof covering shall be installed in accordance with this chapter and the roof covering manufacturer's installation instructions. Flashing shall be installed in accordance with the roof assembly manufacturer's installation instructions and Sections 1503.2 and 1507 where the lightning protection system installation results in a penetration through the roof covering. When the roof covering manufacturer is unknown, installation shall be as directed by a registered design professional.

Commenter's Reason:
Progress was made during the Group A cycle to include Lightning Protection Systems (LPS) and their appropriate installation standards in the IBC (G176-21). However, these standards (NFPA 780 and UL 96A) are currently silent on the impact the attachment of LPS have on the roof.

In order to preserve the building envelope in a wind or weather event, it is critical to maintain the integrity of the roof components which are required by code to be tested and to ensure weatherproofing continuity.

Roof assembly components such as coping, and gutters are required by code to be tested to specific wind loads. Any_attachments to these edge metal systems can alter the wind load on these tested components and therefore the performance of the systems.

This proposal clarifies that attachment of LPS needs to be done in accordance with the manufacturer installation instructions for the roof assembly, roof covering, metal edge systems, or gutter they are being attached to. Manufacturer is defined as a person or business that produced for sale or installation, the roof components referenced above (coping, gutters, roof membranes) and is often the roofing contractor, the roofing membrane manufacturer, or another manufacturing company responsible for the manufacturing of these tested components. Where LPS components attach to or penetrate the roof, they must be properly flashed. There are situations where the manufacturer of the metal edge system, gutter, or roof covering is unknown, or out of business. In these situations, a registered design professional can provide direction on an attachment method that will retain the integrity of the roof, while allowing a lightning protection system to be installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

If the Lightning protection system components are attached by adhesion or screw fasteners there will be no additional impact to costs. If the metal edge manufacturer’s installation instructions require the installation of a bracket or some other device not yet developed there will be an increase in the material and labor to install the lightning protection system and/or roofing system.

Public Comment# 3216

S44-22

IBC: 1512.1

<u>Proposed Change as Submitted</u>

Proponents: Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com)

2021 International Building Code

Revise as follows:

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of $^1/_4$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage* <u>and meet the requirements of Section 1608.3 and Section 1611.2.</u>
2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage*. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2.

Reason: This additional language is necessary to ensure public life-safety. It emphasizes the IBC requirement that susceptible bays be analyzed for ponding instability during structural design/loads analyses that are required incidental to the recovering or replacement of existing *roof coverings,* which adds new live loads to existing roof structures. As the IBC has evolved through periodic updates, there have been fundamental changes in its requirements related to roof drainage, structural requirements for ponding instability, and, with climate change, significant increases in design rain loads (both rainfall intensity and duration). Annually, re-roofing projects comprise about three-quarters of U.S. low-sloped roofing projects. This additional language is needed to reduce the likelihood of catastrophic roof collapses that that occur from uncontrolled ponding and/or inadequate drainage that is directly related to new live loads imposed onto existing roof structures from re-roofing.
The following recent studies and case studies further support, in much greater detail, justification for the proposed additional language to Exception 1.

Fundamental Changes Related to Drainage

A 2012 study published by the American Society of Plumbing Engineers (ASPE) and the International Association of Plumbing and Mechanical Officials (IAPMO) concluded: “The research produced stunning results that verified that the sizing method for storm drainage systems, as required in the plumbing codes, is inaccurate.” (Ballanco 2012) In summary, the roof drains design criteria the engineering/construction industry has been using for more than 70 years is flawed. Drainage assemblies’ flow rates are based on the head of water over the drains and their geometry.

This research led to significant changes to the *IPC*. As of 2015, the IPC no longer publishes flow rates through drains. The IPC requires the designer to use “the published roof drain flow rate” for drainage design. The problem is that, at the time of this writing, there is only one drain manufacturer that publishes flow rates for their roof drains. The only published data on flow through drains is *FM Global Property Loss Prevention Data Sheets 1-54: Roof Loads for New Construction,* which essentially addresses only one type of drain. As a result of these code changes, the IIBEC-RCI Foundation recently published the second edition of *Roof Drainage* (IIBEC-RCI Foundation 2021), which provides an in-depth explanation of the new drainage design criteria and a guide for roof drainage designers. Accordingly, roof drainage systems that were designed per plumbing code requirement prior to IPC 2015 should be re-evaluated as part of roof recovering or replacement over an existing *roof covering.*

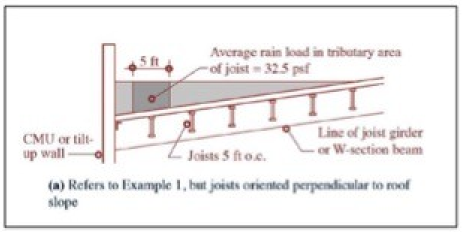
Structural Requirements for Ponding Instability

The second major change to codes involves structural requirements for ponding instability. Currently Section 1512.1 Exception 1 allows slopes less than ¼ inch per foot for re-roofing projects. By definition (2021 IBC Section 202), a *susceptible bay* is “a roof or portion thereof with a slope less than ¼ inch per foot.” Sections 1608.3 and 1611.2 require that *susceptible b*ays be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7. This proposed change allows a slope of less than ¼ inch per foot only if the roof is not susceptible to ponding instability.

ASCE 7-16 significantly revised its “Chapter 8: Rain Loads” (ASCE 2016). Historically, ASCE and the model codes required ponding instability to be investigated when the roof slope was less than ¼ inch per foot. Ponding instability is a serious life-safety and structural issue for roofs. We have also learned that *ponding instability* is not just an issue on roofs with slopes less than ¼-inch per foot, but can also an issue on many more roof configurations. In other words, the potential for roof collapse resulting from ponding instability is more widespread than originally thought, and there are a number of roofs constructed before the 2016 design standards were enacted that have never been analyzed for ponding instability.

The most significant change in the evaluation of ponding instability addressed in ASCE 7-16 is structural orientation. The load on the joists is much greater if the joists are oriented parallel to the wall to which the water drains than if the joists are perpendicular to the wall. Below is example of a collapse in Dallas where ponding instability and structural orientation was an issue. The build-up of water on the 1st and 2nd joists running parallel to the wall was much greater than if the joists had been perpendicular to the wall. This condition resulted in excessive rainwater load on the joists. **Figure 1** (left) shows the roof collapse, and **Figure 1** (right) shows the structural orientation.

Figure 2 is an excerpt from “Roof Drainage Design, Roof Collapses, and the Code” (Patterson and Mehta 2018) illustrating the distribution on a roof with joists running parallel to the drainage wall (Patterson and Mehta 2018). In most cases these joists were designed using a live load of 16 psf, so the rainwater live load is double the design live load.



In a paper by Coffman and Williamson (2019), they discuss ponding that can occur due to differences between “design slope” found in IBC Chapter 15 and “roof slope” used in ASCE 7. Their recommendation is “When design constraints necessitate a 1/4 in 12 design slope be used, the framing members should be cambered or investigated for ponding.”

Increases in Design Rain Loads

ASCE 7-16 also recognized another important roof drainage design issue in “Section 8.2 Roof Drainage.” There have been two rainfall rates used for the design of secondary drainage systems. Currently, the IPC requires a 1-hour, 100-year rainfall rate for designing the secondary drainage system, while the *National Standard Plumbing Code* requires a 15-minute, 100-year rainfall rate for designing the secondary drainage system. The original *IPC* also included the requirement to use a 15-minute, 100-year rainfall rate for designing the secondary drainage system, which was also in the *Standard Plumbing Code* before the IPC replaced it. ASCE 7-16 added the requirement that the secondary drainage system be designed based on the 15-minute, 100-year rainfall rate, which is contrary to the current *IPC* requirements. The *IPC* requirements are also in conflict in the current IBC, which is the reason why this change is important. The 15-minute, 100-year rainfall rate is double (two times) the 1-hour, 100-year rainfall rate. In other words, to comply with ASCE 7 and Section 1608.3 and Section 1611.2 of the IBC*,* the secondary drainage system must be designed using double the design rainfall rate required in the IPC.

As a result, the secondary drainage system design can be based on the IPC and not meet the requirements of ASCE and the IBC. Chapter 3, Sections 3.4 and 3.5 of *Roof Drainage* (IIBEC-RCI Foundation 2021) provides an in-depth discussion of the use and importance of the 15-minute, 100-year design standard for secondary drainage systems. Essentially, ASCE 7 has doubled the ”Rainwater Loads” on roofs.

In addition, Levine (2021) conducted a review of US rainfall intensity data reports and various plumbing codes from 1935 to the present. He found that “plumbing codes have remained relatively static, rarely contain current rainfall intensity data, and truly represent a minimum standard with regard to the design of roof drainage systems.”

Catastrophic Failures Due to Ponding

Ponding water on roofs, the accumulation of water on roofs, or *ponding instability* has the potential to cause serious structural/life safety issues, including roof collapses. There is a precedent for the ICC recognizing the significance of changes in design standards based upon new inputs, especially when related to life-safety issues. “Section 403.5 Bracing for unreinforced masonry parapets upon reroofing” and “Section 403.8 Roof diaphragms resisting wind loads in high-wind regions” in the IEBC require the correction of potentially hazardous conditions from seismic and wind forces. When reroofing a building in a high-wind region, an analysis of the structural diaphragms and correction of the deficiencies are required. IEBC Section 302.1, Dangerous Conditions, gives the building official “the authority to require the eliminate of conditions deemed *dangerous*.” IEBC Section 706.2, Addition or replacement of roofing or replacement of equipment, requires replacement or alteration to structural elements when the structural element’s design dead, live or snow load, including snow drift effects, is increased by 5 percent. In roof recover situations, the additional load from the re-cover roof is not the only increase in gravity loads, because the changes in the IBC and ASCE 7, as discussed previously, have doubled the gravity load from rainwater. These "Rain Loads" changes in ASCE 7 were made to address significant life-safety structural issues related to water accumulation on roofs. Michael O'Rourke, PhD, PE and Aaron Lewis, PE have published an excellent monograph regarding rain loads (O'Rourke and Lewis 2020).

Case Studies of Failures

Case Study 1: Roof Failure in Walhalla, South Carolina, on October 8, 2017 (**Figures 3-4**)

Background:

Construction Science and Engineering, Inc. of Westminster, SC, performed an investigation following the collapse of a roof structure in Walhalla, SC, in October of 2017. Research was limited due to the number of weather recording stations proximate to the subject building; however, a private weather station within 3 miles of the building reported 4.3 in. of rain on the day of the event.

Findings:

In the opinion of Construction Science and Engineering, Inc., the primary cause of the roof collapse was due to excessive and rapid water accumulation on the roof during the significant weather event on October 8, 2017. The reported 5 in. of rainwater reported by the adjacent resident was similar to the 4.3 in. of rainwater measured from the closest private weather station. Additionally, the measured 3.5 in. water depth at the rear of an adjacent building 3 days after the rain event corroborated the reported rain amounts.

A 20 psf unreduced roof design load is specified as the standard in the applicable building code. An accumulation of 5 in. of rainwater equates to approximately 26 psf load on a roof structure. This roof load represents approximately 30% higher load than the current code prescribed design load. Due to the installation of the granular cap sheet below the tile parapet cap, the weight of the water is believed to have initiated the steel truss collapse by pulling a portion of the masonry brick parapet wall onto the roof. This impact force would result in the damage observed at the subject property.

Per Figure 1106.1(3), 100-Year, 1-Hour Rainfall (Inches) Eastern United States provides the 100-year hourly rainfall rate is 4.0 inches for Walhalla, South Carolina.

Case Study 2:

Roof Failure in Kinston, North Carolina, on August 1, 2020 (**Figures 5-7**)

Background:

REI Engineers, Inc. of Greenville, NC, performed an investigation following the collapse of a roof structure in Kinston, NC, in August of 2020.

Findings:

In the opinion of REI Engineers, Inc., the primary cause of the roof collapse was due to excessive loading of the roof framing system. Examination of the roof storm drainage system showed the primary drainage scuppers to obstructed by debris. Additionally, no secondary (emergency) drainage was observed. The combined factors of failure of the primary drainage system and lack of an overflow drainage system most likely caused the excess amount of water to accumulate on the roof, as it was contained by the structure’s parapet. This additional load exceeded the structural framing’s ability and a failure of the framing occurred by collapse.

Bibliography: American Society of Civil Engineers (ASCE). 2016. *ASCE 7 -16*: *Minimum Design Loads Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. Reston, VA: ASCE.
Ballanco, Julius. 2012. *Storm Drainage System Research Project: Flow Rate Through Roof Drains.* Rosemont, IL: American Society of Plumbing Engineers (ASPE) Research Foundation.

Coffman, Scott D., and Thomas Williamson. 2019. “Low-Slope Roofs: Design Solutions for Building Code-Permitted Low-Slope Applications that Cause Ponding Water.”
Civil + Structural Engineering. Fayetteville, AR: Zweig Group.

Levine, Jeffrey. 2021. “Rainfall Intensity Changes Over Time: Have the Codes Kept Pace?,” *Interface*, 39 (10): International Institute of Building Enclosure Consultants.

O'Rourke, Michael, and Aaron R. Lewis. 2020. *Rain Loads: Guide to the Rain Load Provisions of ASCE 7-16*. Reston, VA: ASCE.

Patterson, Stephen, and Medan Mehta. 2021. *Roof Drainage.* Second Edition, Raleigh, NC: IIBEC-RCI Foundation.

Patterson, Stephen L., and Madan Mehta. 2018. "Roof Drainage Design, Roof Collapses, and the Code" in *Proceedings of the 33rd RCI International Convention and Trade Show*, March 22-27, 2018: RCI.

Cost Impact: The code change proposal will increase the cost of construction
Most buildings that will be reroofed already meet IBC requirements, and there will be no increased costs resulting from the proposed additional language. Most residential and multi-family buildings' roofs (typically steep-slope) and commercial buildings' roofs that drain over the edge and buildings with rigid structures will not be affected.

There will be increased costs to buildings with flexible structural elements that are susceptible to *ponding instability,* which leads to roof structure overloading and catastrophic roof collapse. These buildings would fall into the "Dangerous Condition" category, as defined in IEBC Section 401.3 (however, it should be noted that the IEBC is typically a voluntary code is most jurisdictions, and accordingly, this issue needs to be fully discussed in the IBC).

For these "Dangerous Condition" buildings, additional cost would involve a structural engineering evaluation to determine that the building structure with new live loading is safe. In a majority of cases, it is presumed that structural engineering evaluation would be the extent of the additional costs, since building structures are typically designed with sufficient additional safety factors.In cases where a structural engineering evaluation indicates a building/roof structure is unsafe, there would be additional costs to strengthen, supplement, replace or otherwise alter the structure, as required to carry the additional loads. These costs would vary from building-to-building depending upon the extent of the discovered issues. In most cases, overflow drains or scuppers could be added or resized to limit the amount of water that would accumulate on the new roof. Overflow scuppers costs vary from $500 to $1,500 depending on their complexity.

Regardless, the costs to evaluate and/or modify a structure that has been found to be unsafe from additional loading caused by re-roofing, is necessary to protect public life-safety.

S44-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal adds requirements to increase public life-safety relative to ponding instability. The committee encouraged further coordination with the IEBC. (Vote: 9-5)

S44-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.1

Proponents: Mark Graham, representing National Roofing Contractors Assoc. (mgraham@nrca.net) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage*. ~~and~~ Buildings that have not been demonstrated to comply with the ponding instability provisions of IBC 2000 or later editions or ASCE 7-95 or later editions shall also meet the requirements of Section 1608.3 and Section 1611.2.
2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage*. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2.

Commenter's Reason: The original proposal does not currently acknowledge a ponding instability structural evaluation may have already been conducted when the building was originally designed and constructed or in previous reroofing.
This public comment's newly-added language allows ponding instability structural analysis conducted when the building was originally designed and constructed to fulfill this proposal's apparent intent provided it complies with IBC 2000 or later editions or ASCE 7-95 or later editions.

This type of previous edition-type exception is not unprecedented in the I-codes. For example, 2021 IEBC Section 706.3.2-Roof Diaphragms Resisting Wind Loads in High-wind Regions exempts existing buildings from a roof diaphragm analysis when reroofing provided the building is demonstrated to comply with ASCE 7-88 or later editions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There will be no cost increase resulting from this code change and public comment for those buildings where an appropriate ponding instability structural analysis has already been conducted and documented.

Public Comment# 3495

Public Comment 2:

Proponents: Mark Graham, representing National Roofing Contractors Assoc. (mgraham@nrca.net) requests Disapprove

Commenter's Reason: This code change proposal was Approved As Submitted by a split 9-5 committee vote. We respectfully ask for reconsideration of this code change proposal and seek Disapproval on the basis of the following:

- Cost impact is inadequately addressed: While the proponent's cost impact statement estimates the costs of adding overflow scuppers (which is not addressed by this exception), the cost impact statement does not provide data on the costs for conducting the ponding instability structural evaluation being added by this proposal and any resulting costs for modifying the building's structure.
- Previous ponding instability structural evaluation not acknowledged: The proposal does not acknowledge a ponding instability structural evaluation may have already been conducted when the building was originally designed and constructed or in previous reroofing. The provision implies a new ponding instability structural evaluation be conducted based on IBC 2024's Chapter 16 and ASCE 7-22.
- Outside of scope: A requirement for conducting a ponding instability structural evaluation is inappropriately placed in Chapter 15-Roof Assemblies and Rooftop Structures. It can be interpreted this requirement is outside of the scope of Chapter 15 and Section 1512-Reroofing.

  Section 1501.1-Scope indicates the scope of Chapter 15 is as follows: "**1501.1 Scope.** The provisions of this chapter shall govern the design, materials, construction and quality of *roof assemblies*, and *rooftop structures*."

  Section 1512.1-General indicates Section 1512-Reroofing is intended to apply as follows: "**1512.1 General.** Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15."

  The added provision would be more appropriate for IEBC, perhaps in IEBC's Chapter 7-Alterations-Level 1 and specifically Section 706-Structural.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3482

S45-22

IBC: 1512.1

Proposed Change as Submitted

Proponents: Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com)

2021 International Building Code

Revise as follows:

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

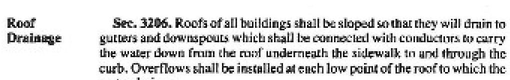
1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage*.
2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage* <u>and have been determined to resist all design loads</u>. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2.

Reason: This amended language is necessary to ensure public life-safety. It clarifies specifically when the Exception 2 is applicable so as to prevent roof collapses/structural overload failures from uncontrolled ponding, incidental to new dead-loads imposed onto existing roof structures, inadequate/missing secondary drainage assemblies at existing roofs, or alteration of drainage assemblies during re-roofing projects. This amended language is also needed to ensure preservation of physical assets or operations covered by existing roofs that are subject to re-roofing. The IBC and its predecessor building codes have long called for scuppers (or other secondary drainage measures) within all roofs that incorporate parapet walls and within other low-slope roofs, to prevent roof-structure overload and collapse. If during a low-slope re-roofing project, an owner discovers that their as-constructed roof has defective or missing code-required emergency overflow or secondary-drainage assemblies, the existing roof was most likely not code-compliant at the time of its installation and was and remains a danger to public life-safety from catastrophic collapse.
The following recent studies further support, in much greater detail, justification for the proposed additional language to Exception 2.

Secondary Drainage Should Have Been Provided During Original Construction

Chapter 15, Section 1502.2 Secondary (emergency overflow) drains or scuppers requires that, "secondary (emergency overflow) drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason." Generally, this provision only applies to low-sloped roofs with parapet walls. As the title suggests, the *secondary drainage system* is an *emergency* system that is required to prevent the roof structures from collapsing in the event of an unsafe buildup of water. The s*econdary (emergency overflow) drains or scuppers* are the safety valves for the roof structure.

Building codes have required that buildings have an
emergency overflow drainage system since modern codes were introduced. Below is an excerpt from Chapter 32 Roof Construction and Covering from the first *Uniform Building Code* (1927) requiring that, "Overflows … (be) installed at each low point to which the water drains." (**Figure 1**)


Roof Drainage

Sec. 3206. Roofs of all buildings shall be sloped so that they will drain to gutters and downspouts which shall be connected with conductors to carry the water down from the roof underneath the sidewalk to and through the curb. Overflows shall be installed at each low point of the roof to which the water drains.

Doesn't Apply to Roofs Designed to Drain Over Edge

The provision for an *emergency overflow drainage system* does not apply to roofs that drain over the edge, which are the vast majority of buildings. These include most residential buildings, multi-family buildings, pre-engineered metal buildings, and buildings with low-slope roofs that drain over the edge into the gutters. The provision only applies to roofs where water can accumulate when the primary drains are blocked, i.e., buildings with parapet walls. A building with parapet walls and no *emergency overflow drainage system* did not meet building codes when they were built and do not meet the building codes today.

Exception: Buildings where the structure is sufficient to support the buildup of water do not require overflow. One example of this would be a concrete structure designed to be a future floor. In many cases, these roofs will support water that would build up to the top of the parapet wall. A typical parapet 2-foot wall would result in 2-feet of water buildup at the perimeter or 125 psf of Rain Load (**Figure 2**).

Exception: Buildings where the structure is sufficient to support the buildup of water do not require overflow. One example of this would be a concrete structure designed to be a future floor. In many cases, these roofs will support water that would build up to the top of the parapet wall. A typical parapet 2-foot wall would result in 2-feet of water buildup at the perimeter or 125 psf of Rain Load.

Secondary Drainage Essential to Structural Integrity

An *emergency overflow drainage system* is essential to the structural integrity of a building. It is the safety valve to prevent an unsafe water buildup on a roof in the case that the primary drainage system is blocked or if the rainfall rate exceeds the design rainfall rate for the primary drainage system. The head of water over an overflow drain or scupper is a critical component in the design calculus for roof structures. Both the IBC and ASCE-7 require that the roof structure be designed to support the weight (head) of water that accumulates over the *emergency overflow drainage system* assuming the primary drainage are blocked. **Figure 3** is an excerpt from Chapter 16, Section 1611.1 from the 2021 IBC describing the design requirements for "Rain Loads."

SECTION 1611
RAIN LOADS

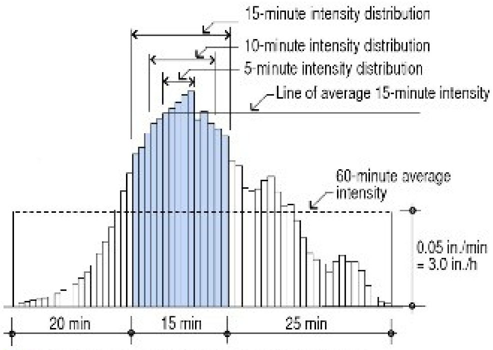
1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the *load* of rainwater as per the requirements of Chapter 8 of ASCE 7. The design rainfall shall be based on the 100-year 15-minute duration event, or on other rainfall rates determined from approved local weather data. Alternatively, a design rainfall of twice the 100-year hourly rainfall rate indicated in Figures 1611.1(1) through 1611.1(5) shall be permitted.

Increases in Design Rain Loads

It is important to note that in the 2021 edition there was a significant change. Previously, the IBC and IPC required using the 1-hour, 100-year rainfall rate for the design of both the primary and secondary drainage systems. Section 1611.1 has changed the design rainfall rate to the 15-minute, 100-year rainfall rate. The requirement to use the 15-minute rainfall rate was made in ASCE 7-16 (ASCE 2016), so both ASCE and IBC require the 15-minute rainfall rate for designing overflow systems. The 15-minute rainfall rate is approximately double the 1-hour rainfall rate. **In other words, to comply with ASCE 7 and Section 1611.1. of the *IBC,* the secondary drainage system must be designed using double the design rainfall rate.** The result is that the new code requirement significantly increases the Rain Load on a building.

The change from the 1-hour to the 15-minute duration rainfall rate is well supported in the technical literature. Chapter 3, Section 3.4 and 3.5 of *Roof Drainage* (IIBEC-RCI Foundation 2021) provides an in-depth discussion of the use and importance of the 15-minute, 100-year design standard for secondary drainage systems. There is also strong precedence in the codes for using the 15-minute rainfall rate for secondary drains. Prior to the consolidation of codes, the *Standard Plumbing Code* required using the 15-minute rainfall rates. The National Standard Plumbing Code requires using the 15-minute rainfall rate. Also, the first IPC required using the 15-minute duration rainfall rate for secondary drain systems. This requirement was changed in the 2000 IPC.

From a structural design perspective, rainfall rates commonly exceed the 1-hour, 100-year rainfall rate for short durations. **Figure 4** is an excerpt from *Roof Drainage* (IIBEC-RCI Foundation 2021) showing a typical distribution of rainfall rates occurring over 1-hour. The area above the 3.0 in/h line illustrate the time when the Rain Load would exceed the design Rain Load using the 1-hour rainfall rate. The illustration also shows (in blue) the 15-minute rainfall rate, which is about double the 1-hour rainfall rate. The Rain Load from 15-minute duration rainfall rate is now recognized as the appropriate standard. These structural design changes were made because of the serious recurring problem of roof collapses.



(a) Rainfall intensity distribution over 60 minutes. Width of each rectangle is one minute.

Climate change is causing more frequent and more intense rain events to occur. A good example was Hurricane Harvey. The flooding in Houston resulting from Hurricane Harvey contributed to the collapse of several roofs. A common scenario was that the flood water filled the storm drainage systems preventing the primary drains from functioning properly. This flooding severely tested the *secondary emergency overflow drainage system*. Most passed the test, but several roofs did not.

Another major change in the IPC significantly affects the design of a *secondary emergency overflow drainage system*. A 2012 study (Ballanco 2012) published by the American Society of Plumbing Engineers and the International Association of Plumbing and Mechanical Officials in found that, "***The research produced stunning results that verified that the sizing method for storm drainage systems, as required in the plumbing codes, is inaccurate***." In other words, **the drainage design criteria we have been using for more than 70 years is wrong … stunning indeed**. The study showed that flow rates are based on the head of water over the drains and the drain geometry, which is the very data a structural engineer must use in determining "Rain Loads." So not only have we changed the rainfall rate for designing secondary emergency drainage systems, we have an entirely different standard for determining the head (weight) of water over the drains.

As stated previously, the requirement that the re-roof system includes an appropriate *emergency overflowdrainage system* has been in the National Codes since these codes addressed reroofing. Chapter 32 Re-Roofing was added to the Appendix of the *Uniform Building Code* in 1979. Chapter 32 Re-Roof required that the new roof *conform the applicable provisions of* Chapter 32 of this code. Section 3207 (c) required Overflow Drains and Scuppers. Below is an excerpt from the 1979 UBC addressing the applicable provision related to the requirement for Overflow Drains and Scuppers. There was a reason that for almost 40 years the codes required the reroofing system to have an appropriate *secondary emergency overflow drainage system* (**Figure 5**).

(c) **Overflow Drains and Scuppers.** Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches above the low point of the roof, or overflow scuppers having three times the size of the roof drains may be installed in adjacent parapet walls with the inlet flow line located 2 inches above the low point of the adjacent roof and having a minimum opening height of 4 inches.

Overflow drains shall be connected to drain lines independent from the roof drains.

Buildings are typically reroofed every 20 years or so. The IBC requires building permits for recovering the existing roof or for reroofing. This is typically the only time during the life of a building that the Building Official and the Code are involved with the roof. This is the appropriate time to make sure the building structure is safe and that the roof drainage system was constructed properly in accordance with the code. The omission of an appropriate *emergency overflow drainage system* is a design and/or construction defect that should be corrected. A building constructed without an appropriate *emergency overflow drainage system* does not meet the code now or in the past. It is critical that this provision be reinstated to ensure our buildings are safe.

Bibliography:

American Society of Civil Engineers (ASCE). 2016. *ASCE 7 -16*: *Minimum Design Loads Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. Reston, VA: ASCE.

Ballanco, Julius. 2012. *Storm Drainage System Research Project: Flow Rate Through Roof Drains*. Rosemont, IL: American Society of Plumbing Engineers (ASPE) Research Foundation.

Coffman, Scott D., and Thomas Williamson. 2019. "Low-Slope Roofs: Design Solutions for Building Code-Permitted Low-Slope Applications that

Cause Ponding Water." *Civil + Structural Engineering*. Fayetteville, AR: Zweig Group.

Levine, Jeffrey. 2021. "Rainfall Intensity Changes Over Time: Have the Codes Kept Pace?," *Interface*, 39 (10): International Institute of Building Enclosure Consultants.

O'Rourke, Michael, and Aaron R. Lewis. 2020. *Rain Loads: Guide to the Rain Load Provisions of ASCE 7-16*. Reston, VA: ASCE.

Patterson, Stephen, and Medan Mehta. 2021. *Roof Drainage.* Second Edition, Raleigh, NC: IIBEC-RCI Foundation.

Patterson, Stephen L., and Madan Mehta. 2018. "Roof Drainage Design, Roof Collapses, and the Code" in *Proceedings of the 33rd RCI International Convention and Trade Show*, March 22-27, 2018: RCI.

Cost Impact: The code change proposal will increase the cost of construction
Most buildings that will be re-roofed already meet IBC requirements, and there will be no increased costs resulting from the proposed additional language. Most residential and multi-family buildings' roofs (typically steep-slope) and commercial buildings with roofs that drain over the edge and buildings with rigid structures will not be affected. The cost of adding parapet wall emergency through-wall scuppers or other secondary drainage measures at low-slope roofs that require such assemblies, should have been borne at the time of the existing low-slope roof's original construction, based on requirements of earlier adopted building codes.

If found to missing, parapet wall through-wall scuppers or other secondary drainage measures are typically of nominal cost to retrofit into existing buildings/roofs. The costs to add or modify an emergency overflow drainage systemvaries. In many cases, all that is required is to add overflow drains or scuppers to control the volume of water that would accumulate on the roof. Overflow scupper costs vary from $500 to $1500 depending on their complexity and overflow drains vary from $1500 to $3000.

There will be increased costs to buildings with flexible structural elements that are susceptible to ponding instability,which leads to roof structure overloading and catastrophic roof collapse. These buildings would fall into the "Dangerous Condition" category, as defined in IEBC Section 302.1. For these "Dangerous Condition" buildings, additional cost would involve a structural engineering evaluation to determine that the building structure with new, added dead-loading is safe and additionally, that the new dead-loading will not alter the function of in-place secondary drainage systems. In most cases, it is presumed that structural engineering evaluation would be the extent of the additional costs, since building structures are typically designed with sufficient margin-of-safety factors.

In cases where a structural engineering evaluation indicates a building/roof structure is unsafe, there would be additional costs to strengthen, supplement, replace or otherwise alter the structure, as required to carry the additional loads. These costs would vary from building-to-building depending upon the extent of the discovered issues.

Regardless, the costs to evaluate and/or modify a structure that has been found to be unsafe from additional loading caused by re-roofing or from inadequate or missing secondary drainage systems, is necessary to protect public life-safety and property/operations below existing roofs.

S45-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage*.

2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage* and ~~have been determined to resist all design loads~~ meet the requirements of Section 1608.3 and Section 1611.2. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2.

Committee Reason: Approved as modified as the proposal provides a reasonable addition, to the exception in section 1512.1, as ponding instability rarely provides warning prior to failure. The committee did note that the proposal could penalize existing buildings. The modification provides the required specific pointer. (Vote: 10-4)

S45-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.1

Proponents: Mark Graham, representing National Roofing Contractors Assoc. (mgraham@nrca.net) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1512.1 General. Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope *roof coverings* shall not be required to meet the minimum design slope requirement of $^{1}/_{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide *positive roof drainage*.
2. Recovering or replacing an existing *roof covering* shall not be required to meet the requirement for secondary (emergency overflow) drains or *scuppers* in Section 1502.2 for roofs that provide for *positive roof drainage*. ~~and~~ Buildings that have not been demonstrated to comply with the ponding instability provisions of IBC 2000 or later editions or ASCE 7-95 or later editions shall also meet the requirements of Section 1608.3 and Section 1611.2. For the purposes of this exception, existing secondary drainage or *scupper* systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or *scuppers* designed and installed in accordance with Section 1502.2.

Commenter's Reason: The original proposal does not currently acknowledge a ponding instability structural evaluation may have already been conducted when the building was originally designed and constructed or in previous reroofing.
This public comment's newly-added language allows ponding instability structural analysis conducted when the building was originally designed and constructed to fulfill this proposal's apparent intent provided it complies with IBC 2000 or later editions or ASCE 7-95 or later editions.

This type of previous edition-type exception is not unprecedented in the I-codes. For example, 2021 IEBC Section 706.3.2-Roof Diaphragms Resisting Wind Loads in High-wind Regions exempts existing buildings from a roof diaphragm analysis when reroofing provided the building is demonstrated to comply with ASCE 7-88 or later editions.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
There will be no cost increase resulting from this code change and public comment for those buildings where an appropriate ponding instability structural analysis has already been conducted and documented.

Public Comment# 3500

Public Comment 2:

Proponents: Mark Graham, representing National Roofing Contractors Assoc. (mgraham@nrca.net) requests Disapprove

Commenter's Reason: This code change proposal was Approved As Modified by a split 10-4 committee vote. We respectfully ask for reconsideration of this code change proposal and seek Disapproval on the basis of the following:

- Cost impact is inadequately addressed: While the proponent's cost impact statement estimates the costs of adding overflow scuppers, the cost impact statement does not provide data on the costs for conducting the ponding instability structural evaluation being added by this proposal and any resulting costs for modifying the building's structure.
- Previous ponding instability structural evaluation not acknowledged: The proposal does not acknowledge a ponding instability structural evaluation may have already been conducted when the building was originally designed and constructed or in previous reroofing. The provision implies a new ponding instability structural evaluation be conducted based on IBC 2024's Chapter 16 and ASCE 7-22.
- Outside of scope: A requirement for conducting a ponding instability structural evaluation is inappropriately placed in Chapter 15-Roof Assemblies and Rooftop Structures. It can be interpreted this requirement is outside of the scope of Chapter 15 and Section 1512-Reroofing.

Section 1501.1-Scope indicates the scope of Chapter 15 is as follows: "**1501.1 Scope.** The provisions of this chapter shall govern the design, materials, construction and quality of *roof assemblies*, and *rooftop structures*."

Section 1512.1-General indicates Section 1512-Reroofing is intended to apply as follows: "**1512.1 General.** Materials and methods of application used for recovering or replacing an existing *roof covering* shall comply with the requirements of Chapter 15."

The added provision would be more appropriate for IEBC, perhaps in IEBC's Chapter 7-Alterations-Level 1 and specifically Section 706-Structural.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3488

S48-22 Part I

IBC: 1512.2; IEBC: [BS] 705.2

Proposed Change as Submitted

Proponents: Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IBC STRUCTURAL CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-B CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2021 International Building Code

Revise as follows:

1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

> **Exception:** Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

<u>Where the existing *roof assembly* contains insulation entirely above the roof deck, installation of roof insulation materials shall comply with Section C503.2.1 of the *International Energy Conservation Code.*</u>

2021 International Existing Building Code

Revise as follows:

[BS] 705.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

> **Exception:** Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the International Building Code.

<u>Where the existing *roof assembly* contains insulation entirely above the roof deck, installation of roof insulation materials shall comply with Section C503.2.1 of the *International Energy Conservation Code*.</u>

Reason: This proposal adds a reference within the IBC, IEBC and IRC provisions relating to roof replacements that points code users to the applicable IECC requirements for roof replacement projects or alterations to the roof assembly where the assembly is part of the building thermal envelope. This proposal adds an important connection between the building code and the energy code, and will improve compliance with the energy code requirements. The new language is intended to appear under the existing exception. Roof replacements are required to comply with the IECC requirements regardless of the reuse of existing materials such as an ice barrier membrane.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal provide clarification of requirements related to roof replacements and creates no new requirements.

Staff Analysis: CC# S48-22 and CC# S49-22 addresses requirements in a different or contradicting manner. The committee is urged to make their intentions clear with their actions on these proposals.

S48-22 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved consistent with the actions on S48-22 Part II. The committee noted that installation should not point to the IECC. The IBC proposal only points to the IECC commercial provisions. (Vote: 14-0)

Staff Analysis: CC# S48-22 Part I and CC# S49-22 Part I addresses requirements in a different or contradicting manner.

S48-22 Part I

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.2; IEBC: [BS] 705.2

Proponents: Wanda Edwards, representing PIMA (we@wandaedwardsconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturer Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

> **Exception:** Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

Where the existing *roof assembly* contains thermal insulation entirely above the roof deck , ~~installation of~~ the above-deck thermal ~~roof~~ insulation ~~materials~~ shall comply with Section C503 ~~C503.2.1~~ for commercial occupancies and Section R503 for residential occupancies as defined ~~of~~ in the *International Energy Conservation Code.*

2021 International Existing Building Code

[BS] 705.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

> **Exception:** Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the International Building Code.

Where the existing *roof assembly* contains thermal insulation entirely above the roof deck , ~~installation of~~ the above-deck thermal ~~roof~~ insulation ~~materials~~ shall comply with Section C503 ~~C503.2.1~~ for commercial occupancies and Section R503 for residential occupancies as defined ~~of~~ in the *International Energy Conservation Code.*

Commenter's Reason: This proposal adds a pointer or reference to the International Energy Conservation Code (IECC) in the International Building Code (IBC), and the International Existing Building Code (IEBC) for roof replacements to comply with the energy code requirements. Roof replacements are classified as alterations, and must comply with the requirements in Section C503.2.1 for commercial occupancies and Section R503 for residential occupancies defined in the IECC. Several important points need to be noted.

- First, the proposal does not create any new requirements for roof replacement activity related to energy efficiency.
- Second, the proposal is a pointer to compliance requirements with provisions in the IECC when roof replacements occur.
- Third, the proposal adds an important connection between the building code and the energy code and will improve energy code compliance. The following modifications were made following the Committee Action Hearings to improve the language in the proposal:
    - During the Committee Action Hearing testimony was provided that reference should be made to Chapter 13 titled “Energy Efficiency” and/or Section 1301 of the IBC. However, Section 1301.1.1 points the user back to the IECC. The specific reference to Section C503 titled “Alterations” is more appropriate, since the energy efficiency requirements applicable to roof replacements are included in this section.
        - Precedent exists in other sections of the building code that reference or point to specific sections of the energy code (i.e., Section 1202.4.3.2 titled "Conditioned Space", and Section 1404.3 titled "Vapor Retarders")
    - The proposed modification references Section C503 and Section R503 rather than a sub-section C503.2.1 and sub-section R503.1.1 to ensure that no mismatch exists when sub-sections are renumber during redevelopment of the energy code (currently in process).
    - Based on the comments from the Committee Action Hearing (CAH), Section R503 titled "Alterations" has been added to respond to one Committee's comments for disapproval because the original proposal only pointed to commercial provisions.
    - The proposed code change modification intends to coordinate terminology with the building code, Section 1508 titled “Roof Insulation” by referring to “above-deck thermal insulation" and remove extraneous language that is not necessary.
    - Finally, the modification applies only to the above-deck thermal insulation, and excludes insulation that may be installed below the roof deck for consistency with the intent of the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal adds no new technical provisions and does not increase or decrease the cost of construction.

Public Comment# 3431

S48-22 Part II

IRC: R908.3

Proposed Change as Submitted

Proponents: Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org)

2021 International Residential Code

Revise as follows:

R908.3 Roof replacement. *Roof replacement* shall include the removal of existing layers of roof coverings down to the *roof deck.*

> **Exception:** Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

Where the existing *roof assembly* is part of the building thermal envelope, the *alteration* shall comply with Section R503.1.1 of the *International Energy Conservation Code*--Residential Provisions.

Reason: This proposal adds a reference within the IBC, IEBC and IRC provisions relating to roof replacements that points code users to the applicable IECC requirements for roof replacement projects or alterations to the roof assembly where the assembly is part of the building thermal envelope. This proposal adds an important connection between the building code and the energy code, and will improve compliance with the energy code requirements. The new language is intended to appear under the existing exception. Roof replacements are required to comply with the IECC requirements regardless of the reuse of existing materials such as an ice barrier membrane.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal provide clarification of requirements related to roof replacements and creates no new requirements.

Staff Analysis: CC# S48-22 and CC# S49-22 addresses requirements in a different or contradicting manner. The committee is urged to make their intentions clear with their actions on these proposals.

S48-22 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal because the pointer to section R503.1.1 of the International Energy Conservation Code or even to chapter 11 is not needed. In addition, the exception in section R503.1.1 is only applicable if the energy use of the building is not increased. Therefore, the exception is not practical for residential roofing contractors to confirm energy use. The committee recommended using different text; for example, "replacement shall be consistent with existing materials" (Vote: 10-0).

S48-22 Part II

Individual Consideration Agenda

Public Comment 1:

IRC: R908.3

Proponents: Wanda Edwards, representing PIMA (we@wandaedwardsconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturer Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org) requests As Modified by Public Comment

Modify as follows:

2021 International Residential Code

R908.3 Roof replacement. *Roof replacement* shall include the removal of existing layers of roof coverings down to the *roof deck*.

> **Exception:** Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

Where the existing *roof assembly* is part of the building thermal envelope, the *alteration* shall comply with Section ~~R503.1.1 of the International Energy Conservation Code--Residential Provisions~~ N1109 of the *International Residential Code*.

Commenter's Reason: This proposal adds a pointer or reference to energy requirements within the International Residential Code (IRC) for roof replacements to comply with the energy code requirements. Several important points need to be noted:

- First, the proposal does not create any new requirements for roof replacement activity related to energy efficiency.
- Second, the proposal is a pointer to compliance requirements in the IRC when roof replacements occur.
- Third, the proposal adds an important connection in the IRC between building requirements and the energy requirements of Chapter 11 and will improve compliance with the energy code., which is paramount to the overall performance of homes as it impacts cost of energy and occupant comfort.
- Finally, the following modifications were made following the Committee Action Hearings to improve the language in the proposal:
    - During the Committee Action Hearing testimony was provided that reference should be made to Chapter 11 titled “Energy Efficiency” and not the IECC. The reference to Section N1109 titled “Existing Buildings” is appropriate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal provides clarification of requirements related to roof replacements and creates no new requirements.

Public Comment# 3376

S53-22

IBC: 1512.2; IEBC: [BS] 705.2

Proposed Change as Submitted

Proponents: Bill McHugh, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

2021 International Building Code

Revise as follows:

1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

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

1. Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.
2. *Roof replacement* of existing *low sloped roofs* shall comply with the roof insulation requirements for new construction unless the installation of additional insulation above the structural roof deck is infeasible due to the height of existing parapets, equipment curbs, skylight curbs, window sills, door thresholds, and similar elements with flashing into the roof system. In no case shall a *roof replacement* reduce the insulating value of the roof.

2021 International Existing Building Code

Revise as follows:

[BS] 705.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

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

1. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the International Building Code.
2. *Roof replacement* of existing *low sloped roofs* shall comply with the roof insulation requirements for new construction unless the installation of additional insulation above the structural roof deck is infeasible due to the height of existing parapets, equipment curbs, skylight curbs, window sills, door thresholds, and similar elements with flashing into the roof system. In no case shall a *roof replacement* reduce the insulating value of the roof.

Reason: A major jurisdiction, the City of Chicago, in its adoption of the I-Codes, put this in Chapter 3 of the 2019 Chicago Building Rehabilitation Code, their version of the International Existing Building Code. The City of Chicago has this in its 2016 Chicago Roofing Memorandum. The State of Illinois and Minnesota both have similar language in their adoptions of the I-codes as well.
To be consistent with the IBC and IEBC format, a slight edit was made to the Chicago Rehabilitation Code to remove *roof recover'* from the proposal. That would be covered in a separate proposal.

This proposal provides the building official clear guidance for roof replacements on existing buildings where there are limitations to what can be done on the rooftop, with the structure itself, when a new roof is needed on an existing building.

The structure's characteristics, set during design, do not always provide vertical flashing heights above the roof membrane surface that can allow thicker materials below the membrane, additional deck materials, or insulation, when a new roof is needed, without rebuilding some number of elements on the rooftop.

Cost Impact: The code change proposal will decrease the cost of construction
By not rebuilding the rooftop, the building owner and manager does reduce costs to what the limitations of the building present.

S53-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal's new exception is actually a provision. The committee was concerned on who would determine what is 'infeasible' in the new exception to 1512.2. The committee noted that this is an IECC topic. (Vote: 14-0)

S53-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.2; IEBC: [BS] 705.2

Proponents: Bill McHugh, representing Chicago Roofing Contractors Association (bill@mc-hugh.us) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1512.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of *roof assembly* materials down to the *roof deck*.

Exceptions:

1. Where the existing *roof assembly* includes an ice barrier membrane that is adhered to the *roof deck*, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.
2. *Roof replacement* of existing *low sloped roofs* ~~shall comply with the roof insulation requirements for new construction unless~~ <u>where</u> the installation of additional insulation above the structural roof deck is infeasible due to the height of existing parapets, equipment curbs, skylight curbs, window sills, door thresholds, and similar elements with flashing into the roof system<u>, as determined by the code official</u>. In no case shall a *roof replacement* reduce the insulating value of the roof.

2021 International Existing Building Code

[BS] 705.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

Exceptions:

1. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the International Building Code.
2. *Roof replacement* of existing *low sloped roofs* shall comply with the roof insulation requirements for new construction unless the installation of additional insulation above the structural roof deck is infeasible due to the height of existing parapets, equipment curbs, skylight curbs, window sills, door thresholds, and similar elements with flashing into the roof system. In no case shall a *roof replacement* reduce the insulating value of the roof.

Commenter's Reason: This proposal deals with when flashing heights are too low to accommodate new construction insulation thicknesses. Incorporating the additional insulation means increased construction of the roof assembly and walls, roof edges, to be able to install the new construction code required insulation thicknesses. Everything from gas lines, electrical, HVAC units and curbs, skylights, and other rooftop items need to be raised to meet flashing heights needed. Adequate flashing heights prevent wind driven rain and snow from blowing up under flashing, or over, flashing.
The committee rejection was partially based on who decides if there is a technical infeasibility on the rooftop. To answer the committee's objection, the code official has been added as the deciding individual of whether or not there is a technical infeasibility.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This proposal decreases the total cost of roofing when there are flashing height issues, not high enough to accommodate new construction insulation thicknesses. This decrease is only in force when the technical infeasibility exists.

Public Comment# 3334

Public Comment 2:

Proponents: Wanda Edwards, representing PIMA (we@wandaedwardsconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturer Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org) requests Disapprove

Commenter's Reason: This proposal should be disapproved because it adds unnecessary and confusing language regarding wall and curb flashing heights. Flashing height requirements are appropriately addressed in manufacturer's installation instructions and existing IBC requirements.·

- The proposal exempts existing roofs from energy code compliance when roof replacement activity occurs, and thus creates a loophole with the energy code compliance provisions in the International Energy Conservation Code (IECC).
- The proposal includes a list of rooftop conditions but lacks requirements to what extent such conditions limit compliance with the provisions of the energy code. Example, R-15 roof assembly in climate zone (zone 5) with current prescriptive (R-value) requirements may need to be brought up to R-30. The proposed language provides indefinite exemption to energy code requirements.
- This issue is being adjudicated in the current IECC code development cycle. Multiple proposals have been submitted on this topic and are being discussed. The IECC is the appropriate code for the inclusion of these provisions, because the energy efficiency of the building thermal envelope (specifically roof) is impacted directly.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment does not increase the cost of construction since the current code requirements are not affected.

Public Comment# 3344

S59-22 Part I

IBC: 1512.4; IEBC: [BS] 705.4

Proposed Change as Submitted

Proponents: Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IBC STRUCTURAL CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC-B CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2021 International Building Code

Revise as follows:

1512.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing *ballast* that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled. <u>Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.</u>

2021 International Existing Building Code

Revise as follows:

[BS] 705.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled. <u>Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.</u>

Reason: This code change proposal recognizes that roof insulation boards that are in good repair may be appropriately reused as part of a reroofing project. The new language is written in the negative (i.e., when reuse is not permissible) to match the existing provisions for the reinstallation of roofing materials. This code change proposal will reduce the amount of construction materials that are landfilled during a reroofing project by clarifying the appropriate circumstances under which roof insulation boards may be reused.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal does not impose any new requirements for reroofing projects. Therefore, the proposal will not increase or decrease the cost of construction. Where roof insulation is reused as part of a reroofing project, the provision may reduce the cost of construction by reducing the quantity of new roofing materials purchased to complete the project.

S59-22 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as per the proponent request consistent with the actions on S59-22 Part II. (Vote: 14-0)

S59-22 Part I

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.4; IEBC: [BS] 705.4

Proponents: Wanda Edwards, representing PIMA (we@wandaedwardsconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturer Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1512.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing above-deck thermal insulation, vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing *ballast* that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled. ~~Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.~~

2021 International Existing Building Code

[BS] 705.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing above-deck thermal insulation, vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled. ~~Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.~~

Commenter's Reason: This code change proposal recognizes that roof insulation boards that are in good condition may be reused as part of a reroofing project. This code change proposal will reduce the amount of construction materials that are landfilled during a reroofing project by clarifying when roof insulation boards may be reused. This is a modification to the original proposal following the Committee Action Hearing (CAH). The last sentence that was part of the original proposal submission is stricken to recognize testimony during the CAH regarding definition for “water soaked." The specific language added to the modification, “above-deck thermal insulation,” intends to move language from the stricken sentence into the charging language. Finally, the terminology was also changed to align with the current language in the International Building Code in Section C1508 title "Roof Insulation".

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code change proposal does not impose any new requirements for reroofing projects. Therefore, the proposal will not increase or decrease the cost of construction. Where roof insulation is reused as part of a reroofing project, the provision may reduce the cost of construction by reducing the quantity of new roofing materials purchased to complete the project.

Public Comment# 3337

S59-22 Part II

IRC: R908.5

Proposed Change as Submitted

Proponents: Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

2021 International Residential Code

Revise as follows:

R908.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Any existing flashings, edgings, outlets, vents or similar devices that are a part of the assembly shall be replaced where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled. <u>Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.</u>

Reason: This code change proposal recognizes that roof insulation boards that are in good repair may be appropriately reused as part of a reroofing project. The new language is written in the negative (i.e., when reuse is not permissible) to match the existing provisions for the reinstallation of roofing materials. This code change proposal will reduce the amount of construction materials that are landfilled during a reroofing project by clarifying the appropriate circumstances under which roof insulation boards may be reused.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal does not impose any new requirements for reroofing projects. Therefore, the proposal will not increase or decrease the cost of construction. Where roof insulation is reused as part of a reroofing project, the provision may reduce the cost of construction by reducing the quantity of new roofing materials purchased to complete the project.

S59-22 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal because the proposed text is not clear. In addition, the committee has an issue with the fact that the proposed language is written in the negative "shall not be reused or reinstalled" (Vote: 9-1).

S59-22 Part II

Individual Consideration Agenda

Public Comment 1:

IRC: R908.5

Proponents: Wanda Edwards, representing PIMA (we@wandaedwardsconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturer Association (mpazera@pima.org); Richard Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org) requests As Modified by Public Comment

Modify as follows:

2021 International Residential Code

R908.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled.<u> Existing above-deck thermal insulation or</u> ~~Any~~ <u>any </u>existing flashings, edgings, outlets, vents or similar devices that are a part of the assembly shall be replaced where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled. ~~Existing roof insulation boards that are damaged, deteriorated or water soaked shall not be reused or reinstalled.~~

Commenter's Reason: This code change proposal recognizes that roof insulation boards in good condition may be reused as part of a reroofing project. This code change proposal will reduce the amount of construction materials that are landfilled during a reroofing project by clarifying when roof insulation boards may be reused. This is a modification to the original proposal and address feedback from the Committee Action Hearing (CAH). The last sentence that was part of the original proposal submission is stricken to recognize testimony during the CAH regarding definition for “water soaked." The specific language added to the modification, “above-deck thermal insulation,” intends to move language from the stricken sentence into the charging language. This change also addresses Committee member feedback that the original proposal was written in the negative. Finally, the terminology was also changed to align with the current language in the International Building Code in Section 1508 titled "Roof Insulation".

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code change proposal does not impose any new requirements for reroofing projects. Therefore, the proposal will not increase or decrease the cost of construction. Where roof insulation is reused as part of a reroofing project, the provision may reduce the cost of construction by reducing the quantity of new roofing materials purchased to complete the project.

Public Comment# 3340

S60-22

IBC: 1512.4, 1512.5 (New), 1512.5.1 (New), 1512.5; IEBC: [BS] 705.4, 705.5 (New), 705.5.1 (New), [BS] 705.5

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Building Code

1512.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing *ballast* that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

Add new text as follows:

1512.5 Reinstallation of equipment. Existing installations of rooftop-mounted photovoltaic (PV) panel systems approved under previous code requirements are permitted to remain in use, in accordance with NFPA 70 and this code.

1512.5.1 Permit for reinstalled equipment. Existing rooftop-mounted photovoltaic (PV) panel systems shall be permitted for reinstallation after roof repair or replacement, provided all of the following are provided:

1. The installation of the original equipment was permitted and approved.
2. The permit is obtained by a qualified person for the removal and reinstallation of the equipment.
3. At the time of application for permit, the applicant shall provide at least one of the following:
   3.1 A copy of the original approved plans that includes the equipment.
   3.2 Where plans are unavailable, photographs of the existing rooftop-mounted PV panel system prior to removal.

Revise as follows:

~~**1512.5**~~ **1512.6 Flashings.** Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

2021 International Existing Building Code

[BS] 705.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

Add new text as follows:

705.5 Reinstallation of equipment. Existing installations of rooftop-mounted *photovoltaic (PV) panel systems* approved under previous code requirements are permitted to remain in use, in accordance with *NFPA 70* and the *International Building Code.*

705.5.1 Permit for reinstalled equipment. Existing rooftop-mounted *photovoltaic (PV) panel systems* shall be permitted for reinstallation after roof repair or replacement, provided all of the following are provided:

1. The installation of the original equipment was permitted and approved.
2. The permit is obtained by a qualified person for the removal and reinstallation of the equipment.
3. At the time of application for permit, the applicant shall provide at least one of the following:
   3.1. A copy of the original approved plans that includes the equipment.
   3.2 Where plans are unavailable, photographs of the existing rooftop-mounted *PV panel system* prior to removal.

Revise as follows:

[BS] ~~**705.5**~~ **705.6 Flashings.** Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

Reason: The Sustainable Energy Action Committee (SEAC) has recognized that PV systems often continue to have useful life after the time that a roof covering or roof assembly is in need of repair or replacement. A guidance document has been prepared by SEAC to address this concern. Following is a link to the document, and an excerpt that is include on the SEAC web site.

https://sustainableenergyaction.org/resources/reinstallation-of-pv-system/

The growing number of re-roofing projects on buildings that have photovoltaic panel systems installed is prompting AHJs to search for sensible guidelines to ensure safety codes are followed. SEAC has developed the following permitting and inspection guidelines in an effort to support the inspection community and the growing number of re-roofing projects that involve an existing photovoltaic panel system.These guidelines pertain to the following activities:

1. Removing a previously installed, inspected, and approved photovoltaic panel system. Followed by…
2. Repairing or replacing the roof surface below the photovoltaic panel system. Followed by…
3. Reinstallation of the previously installed, inspected, and approved photovoltaic panel system.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal simply clarifies the ongoing use of approved equipment after roof repair or replacement, so does not impact the cost of construction.

S60-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as not an appropriate change for Chapter 15. In section 1512.5.1, the term 'original equipment' could be confusing. The phrase 'permit is obtained by a qualified person' is inappropriate for code language. (Vote: 14-0)

S60-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1512.5, 1512.5.1; IEBC: 705.5, 705.5.1

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1512.5 Reinstallation of ~~equipment~~ rooftop-mounted photovoltaic (PV) panel systems. Existing installations of rooftop-mounted photovoltaic (PV) panel systems approved under previous code requirements ~~are~~ shall be permitted to ~~remain in use~~ be reinstalled, in accordance with NFPA 70 and this code.

1512.5.1 Permit for reinstalled ~~equipment~~ rooftop-mounted photovoltaic (PV) panel systems. Existing rooftop-mounted photovoltaic (PV) panel systems shall be permitted for reinstallation after *roof repair* or *roof replacement,* ~~provided~~ in accordance with all of the following ~~are provided~~:

1. The original installation of the ~~original equipment~~ rooftop-mounted *PV panel system* was permitted and approved.
~~2. The permit is obtained by a qualified person for the removal and reinstallation of the equipment.~~
~~3~~ 2. At the time of application for permit, the applicant shall provide at least one of the following:
   ~~3.1~~ 2.1. A copy of the original approved plans that includes the ~~equipment~~ existing rooftop-mounted *PV panel system*.
   ~~3.2~~ 2.2. Where plans are unavailable, photographs of the existing rooftop-mounted *PV panel system* prior to removal.

2021 International Existing Building Code

705.5 Reinstallation of ~~equipment~~ rooftop-mounted photovoltaic (PV) panel systems. Existing installations of rooftop-mounted *photovoltaic (PV) panel systems* approved under previous code requirements ~~are~~ shall be permitted to ~~remain in use~~ be reinstalled, in accordance with *NFPA 70* and the *International Building Code*.

705.5.1 Permit for reinstalled ~~equipment~~ rooftop-mounted photovoltaic (PV) panel systems. Existing rooftop-mounted *photovoltaic (PV) panel systems* shall be permitted for reinstallation after *roof repair* or *roof replacement,* ~~provided~~ in accordance with all of the following ~~are provided~~:

1. The original installation of the ~~original equipment~~ rooftop-mounted *PV panel system* was permitted and approved.
2. ~~2. The permit is obtained by a qualified person for the removal and reinstallation of the equipment.~~
3. ~~3~~ 2. At the time of application for permit, the applicant shall provide at least one of the following:
   ~~3.1.~~ 2.1. A copy of the original approved plans that includes the ~~equipment~~ existing rooftop-mounted *PV panel system*.

   ~~3.2~~ 2.2. Where plans are unavailable, photographs of the existing rooftop-mounted *PV panel system* prior to removal.

Commenter's Reason: This proposed code change is appropriate for Chapter 15 of the IBC, because the scope of Section 1512 is reroofing. This proposal provides minimum requirements for the reuse of the rooftop-mounted PV panel system that was temporarily removed in order to recover or replace the existing roof covering.
The original proposal has been revised to address the concerns and questions raised at the Committee Action Hearing regarding what is “original equipment” and a “qualified person”.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change proposal simply clarifies the ongoing use of approved equipment after roof repair or replacement, so does not impact the cost of construction.

Public Comment# 3530

Public Comment 2:

IBC: 1512.5, 1512.5.1; IEBC: 705.5, 705.5.1

Proponents: Evelyn Butler, representing Solar Energy Industries Association (ebutler@seia.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

~~**1512.5 Reinstallation of equipment.** Existing installations of rooftop-mounted photovoltaic (PV) panel systems approved under previous code requirements are permitted to remain in use, in accordance with NFPA 70 and this code.~~

~~**1512.5.1**~~ **1512.4.1** ~~**Permit for reinstalled equipment**~~ **Reinstallation of rooftop-mounted photovoltaic (PV) panel systems.** ~~Existing rooftop-mounted photovoltaic (PV) panel systems shall be permitted for reinstallation after roof repair or replacement, provided all of the following are provided:~~ Existing installations of rooftop-mounted *PV panel systems* shall be permitted to be reinstalled after *roof repair* or *roof replacement* in accordance with all of the following:

1. The original installation of the ~~original equipment~~ rooftop-mounted *PV panel system* was permitted and approved.
2. ~~The permit is obtained by a qualified person for the removal and reinstallation of the equipment.~~ The rooftop-mounted *PV panel system* is reinstalled in accordance with NFPA 70 and this code.
3. At the time of application for permit, the applicant shall provide at least one of the following:
   3.1 A copy of the original approved plans that includes the ~~equipment~~ existing rooftop-mounted *PV panel system*.

   3.2 Where plans are unavailable, photographs of the existing rooftop-mounted *PV panel system* prior to removal.

2021 International Existing Building Code

~~**705.5 Reinstallation of equipment.** Existing installations of rooftop-mounted *photovoltaic (PV) panel systems* approved under previous code requirements are permitted to remain in use, in accordance with *NFPA 70* and the *International Building Code.*~~

~~**705.5.1**~~ **705.4.1** ~~**Permit for reinstalled equipment**~~ **Reinstallation of rooftop-mounted photovoltaic (PV) panel systems.** ~~Existing rooftop-mounted *photovoltaic (PV) panel systems* shall be permitted for reinstallation after roof repair or replacement, provided all of the following are provided:~~
Existing installations of rooftop-mounted *PV panel systems* shall be permitted to be reinstalled after *roof repair* or *roof replacement*, in accordance with all of the following:

1. The original installation of the ~~original equipment~~ rooftop-mounted *PV panel system* was permitted and approved.

2. ~~The permit is obtained by a qualified person for the removal and reinstallation of the equipment.~~

   The rooftop-mounted *PV panel system* is reinstalled in accordance with NFPA 70 and the *International Building Code*.

3. At the time of application for permit, the applicant shall provide at least one of the following:
   3.1. A copy of the original approved plans that includes the ~~equipment~~ existing rooftop-mounted *PV panel system*.

   3.2 Where plans are unavailable, photographs of the existing rooftop-mounted *PV panel system* prior to removal.

Commenter's Reason: This proposed code change is appropriate for Chapter 15 of the IBC, because the scope of Section 1512 is reroofing. This proposal provides minimum requirements for the reuse of the rooftop-mounted PV panel system that was temporarily removed in order to recover or replace the existing roof covering.
The original proposal has been revised to address the concerns and questions raised at the Committee Action Hearing regarding what is “original equipment” and a “qualified person”.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change proposal simply clarifies the ongoing use of approved equipment after roof repair or replacement, so does not impact the cost of construction.

Public Comment# 3531

S70-22

IBC: TABLE 1604.5

Proposed Change as Submitted

Proponents: Homer Maiel, PE,CBO, representing ICC Tri-Chapter (Peninsula, East Bay, Monterey Bay) (hmaiel@gmail.com)

2021 International Building Code

Revise as follows:

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

Portions of table not shown remain unchanged.

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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. Storm shelters in accordance with Section 423.1

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: This is simply cross refering a table to a section and a section to a table. In Section 423.1 there is mention of storm shelters to comply with Table 1604.5 as a Risk Cat. IV. However, table does not mention Section 423.1.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is simply an editorial clarification; make a section and a table to reference each other.

S70-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposed Risk Category IV reference to section 423.1 for storm shelters could cause confusion. (Vote: 14-0)

S70-22

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1604.5

Proponents: Homer Maiel, PE, CBO, representing ICC Tri-Chapter (hmaiel@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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

	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. Emergency ~~Storm~~ shelters in accordance with Section 423.1

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 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 that 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.

Commenter's Reason: The public comment modification addresses the concern that the committee and the speakers had.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is simply an editorial clarification; make a section and a table to reference each other.

Public Comment# 3435

S74-22

Proposed Change as Submitted

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov)

2021 International Building Code

Revise as follows:

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. ~~Group I-2, Condition 1 occupancies with 50 or more care recipients.~~ ~~Group I-2, Condition 2 occupancies not having emergency 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 <u>and buildings where loss of function represents a substantial hazard to occupants</u>, including but not limited to: Group I-2 <u>occupancies</u>~~, Condition 2 occupancies having emergency surgery or emergency treatment facilities.~~

RISK CATEGORY	NATURE OF OCCUPANCY
	Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: This proposal improves consistency in the assignment of risk categories. It applies current thinking from IBC Chapters 3 and 4 to the risk category assignments in Table 1604.5. The logic of the proposal is as follows:

1. **Risk Category IV is the IBC's main tool to provide functional facilities** soon after a natural hazard event (earthquake, flood, snow, or wind). In terms of post-event functionality, there is a wide gap between RC II-III facilities (which have identical requirements for nonstructural systems) and RC IV facilities. The difference in expected recovery time can be on the order of weeks or months.
2. The performance gap between RC II-III and RC IV is most acute for occupancies that depend on functional nonstructural systems and special design provisions to serve vulnerable users.
3. Because these facilities are rare and specially designed, their services and occupants cannot be quickly relocated to other buildings.
4. Therefore, facilities with special design features and vulnerable users should be strong candidates for Risk Category IV.

Following this logic, this proposal expands the scope of RC IV from just "essential facilities" to include "buildings where loss of function represents a substantial hazard." **This "substantial hazard" can even be life threatening** where, for example, a 24-hour medical facility, residential care facility, public water or power utility, detention center with impeded egress, or critical supply chain facility is out of service for weeks. The code defines *essential facilities* as those that need to "remain operational" through and after an "extreme" earthquake, flood, wind, or snow event. The additional facilities described by the logic above and considered in this proposal might not require continuous operation, but **prolonged downtime – which can be expected from RC II design criteria – can give rise to a similar risk for vulnerable users**, if not on Day 1 after the event, then possibly by Day 3, 10, or 30.

This proposal addresses *medical care* facilities assigned to Group I-2. Many design professionals assume all hospitals, typically assigned to Group I-2, are already assigned to RC IV, but that is only true for facilities that provide emergency surgery or emergency treatment. (Even "in-patient stabilization," which is part of what defines Group I-2 Condition 2, does not currently qualify for RC IV.) Many Group I-2 facilities, which include hospitals, nursing homes, and detoxification facilities, are assigned to RC II or RC III, even though they provide **24-hour *medical care*** for patients who are ***incapable of self-preservation***, and even though they are already required to meet special design requirements for corridors, egress plans, etc. in Section 407. Under the current code, Group I-2 facilities with fewer than 50 patients are not even assigned to RC III.

Because of the specialized nature of the care provided, the vulnerability of the patients, and the special design features, none of which would be available in typical RC II buildings, no Group I-2 facility designed under the current code could reasonably be expected to provide or relocate its normal services in a timely fashion after a design-level storm or earthquake. Therefore, this proposal reassigns all Group I-2 facilities to RC IV.

Despite this reassignment, this proposal is measured in its scope. **It does NOT affect:**

- Medical care facilities for 5 or fewer residents. Per Section 308.3, Group I-2 applies only to larger facilities.
- Any *medical care* facility eligible for design under the IRC.
- Outpatient or *ambulatory care facilities* (even those subject to Section 422), including "urgent care" businesses, dialysis centers, dentists, optometrists, or similar clinics; these are typically Group B. (Ambulatory care facilities with emergency surgery or emergency treatment facilities are already assigned to RC IV.)
- Pharmacies or drug stores, typically Group M.
- Medical office buildings, typically Group B.Medical supply or equipment manufacturers, warehouses, or stores.**This proposal is consistent with current IBC principles.** This proposal extends the current scope of Risk Category IV, but it does so consistent with the purpose, philosophy, and normative goals the IBC already represents.

Even if you think of the IBC as strictly a "life safety" code, safety is more than mere survival, and safety can be at risk even after the rain, snow, or ground shaking has stopped. If building damage affects the safety of vulnerable users in the following days or weeks, it is consistent with even a safety-based code to manage those risks through design.

But the IBC's purpose is broader than just "life safety." Section 101.3 states that the purpose of the IBC is to provide a "reasonable level of safety, **health and general welfare**." So a focus on the health and welfare of vulnerable building users, even where their building provides immediate safety, is both "reasonable" and completely consistent with the purpose of the code.

With its definition of *essential facilities* and its use of Risk Category IV to ensure they "remain operational," the IBC is already more than a safety code. It is, in fact, already a basic "functional recovery" code; the only question is which building uses, and users, we decide should qualify for a designed recovery. Where RC II or RC III is not reliable enough, it is consistent with the purpose and scope of the IBC to assign more building uses to RC IV.

Not all of the IBC's tools are perfectly nuanced. Some involve bright lines and broad categories, and it is sometimes necessary to err on the conservative side. So even if a certain use is not quite as "essential" as a fire station, RC IV might still be a more appropriate choice than RC II or RC III, and in these cases, it is consistent with the code to assign buildings to the higher category. In time, design criteria should evolve to address more specific recovery objectives (FEMA, 2020; FEMA-NIST, 2021). But those nuanced provisions are *at least* a decade away. For now, however, RC IV is the most appropriate tool we have, and we ought to use it. Adapting existing practices to new objectives is entirely consistent with the history of code development.

IBC Chapters 3 and 4 define and provide special requirements to manage fire and egress risks for particular groups of users. Table 1604.5 is meant to do the same for rare natural hazard events. But while Chapters 3 and 4 consider dozens of specific building uses and conditions, Table 1604.5 has only four categories. Changing the scope of Risk Category IV to account for specific building uses that are not adequately served by RC II or RC III criteria is consistent with the detailed, use-specific approach of Chapters 3 and 4.

Table 1604.5 represents public policy about what we desire from our buildings. As such, it has changed over time, along with public expectations. As we consider new or increasing risks related to more frequent natural hazard events, urbanization, the pandemic, or aging populations, it is both appropriate and consistent with past practice for Table 1604.5 to evolve as well.

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Almufti, I. et al. (2016). "The resilience-based design of 181 Fremont Tower," *Structure*, June.

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CISA, 2020. "Guidance on the Essential Critical Infrastructure Workforce: Ensuring Community and National Resilience in COVID-19 Response (Version 2.0)." U.S. Department of Homeland Security, Cybersecurity & Infrastructure Security Agency, March 28.

FEMA (2020b). *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures, Volume II: Part 3 Resource Papers*, 2020 Edition, FEMA P-2082-2, prepared by the Building Seismic Safety Council of the National Institute of Buildings Sciences for Federal Emergency Management Agency, September.

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SEFT Consulting Group (2015). "Beaverton School District Resilience Planning for High School at South Cooper Mountain and Middle School at Timberland," SEFT Consulting Group, July 10.

SFDPH, 2020. "Order of the Health Officer No. C19-07b." City and County of San Francisco, Department of Public Health, March 31, et seq.

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

This proposal will increase the cost of construction for the buildings newly assigned to RC IV. The largest increases will likely be in high seismic areas where assignment to RC IV makes the largest changes to structural and nonstructural design criteria. This does not mean, however, that every RC IV facility will have the same unit cost as a new state-of-the-art hospital. On the contrary, case studies of voluntary RC IV-like seismic design have found a **construction cost premium ranging typically from 0% to 2%** relative to normal RC II designs. (See proposal references by Almufti, Bade, Berkowitz, Mar, and SEFT.) This estimate stands to reason: Wind, snow, and earthquake loads can already vary significantly within a jurisdiction, but the building designs and unit costs don't change wildly from one side of the county to the other. For example, the seismic design force in Berkeley is about 1.5 times that in downtown San Francisco; so with respect to the structure, any nursing home or grocery store you can build as RC II in Berkeley you can also build as RC IV in San Francisco with no change to the design. The same is likely true for snow design, for example, in Vail v. Boulder and for wind design in Galveston v. the west side of Houston. On the nonstructural side, a facility's nonstructural systems might need more bracing or support when assigned to RC IV, but the number and size of the components themselves don't suddenly look like a hospital just because the risk category has changed.

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal fills a need for Group I-2 facilities for those who are incapable of self-preservation. The committee expressed concerns on how the proposal may affect smaller facilities. (Vote: 8-6)

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1604.5

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. 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.

RISK CATEGORY	NATURE OF OCCUPANCY
	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 and buildings where loss of function represents a substantial hazard to occupants, including but not limited to: Group I-2, Condition 1 occupancies with 17 or more care recipients. Group I-2, Condition 2 occupancies. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that 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.

Commenter's Reason: This comment acknowledges and responds to the committee's reason statement regarding concerns that proposal S74 could inhibit development of small facilities. It effectively undoes the effect of S74 for relatively small facilities assigned to the less critical and less specialized Condition 1.

Three notes for reference:

- By definition (IBC Sec 308.3), ALL Group I-2 occupancies, of ANY size, provide *24-hour medical care* to patients *incapable of self-preservation*, and all are subject to special design requirements for corridors, egress, smoke barriers, cooking facilities, etc. per Section 407.
- The difference between Group I-2 Condition 1 and Condition 2 is that Condition 1 facilities do NOT support emergency care, surgery, obstetrics, or in-patient stabilization, while Condition 2 facilities CAN support those uses.
- Facilities with up to 5 patients, even if they provide identical care, are assigned to Group R-3, not Group I-2, so these small facilities are not affected by proposal S74, with or without this public comment.

As proponents, we believe that the general nature of Group I-2 -- 24-hour medical care for highly vulnerable patients -- justifies assignment to Risk Category IV. The Structural Committee, by an admittedly narrow margin, agreed. Nevertheless, to accommodate the concern for small facilities, this comment would relax the approved requirement for Condition 1 facilities with up to 16 care recipients.

Why just Condition 1? Because Table 1604.5 already makes this distinction, allowing lower criteria based on the number of patients only for Condition 1. Further, the nature of Condition 2 already indicates a much higher construction budget (and building valuation) than Condition 1, so the effect of S74 should be be proportionally smaller for Condition 2 facilities of the same size.

Why "17 or more"? That might seem like an unusual number, but it follows a precedent set by the definition of Group I-1 (Section 308.2). The current code sets higher criteria for Condition 1 facilities with "50 or more" patients, but from our perspective, a Group I-2 facility with 30, 40, or more vulnerable patients is not a "small" facility whose construction would be inhibited by S74. Consistent with our persuasive testimony at the code action hearings, a facility with no more than 16 patients will be far more feasible to evacuate and relocate when the building is shut down for weeks of repair after a design event than one with up to 49 patients.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

The expected cost increase will be SMALLER with this public comment, since certain Condition 1 facilities would no longer be affected.

Public Comment 2:

Proponents: Heidi Tremayne, representing Earthquake Engineering Research Institute (heidi@eeri.org) requests As Submitted

Commenter's Reason: I would like to express **SUPPORT** for the code change proposal S74-22 on behalf of the Earthquake Engineering Research Institute (EERI). This proposal exemplifies EERI's vision by recommending a clear and important action to improve the International Building Code. Once adopted, this code change will improve the seismic performance of new medical care facilities assigned to Occupancy Group I-2, in alignment with recommendations from EERI's published policy statements. Thank you for considering EERI's position on this important code issue.

EERI's formal letter of support can be downloaded at: https://www.cdpaccess.com/public-comment/3341/27368/files/download/3611/EERI-SUPPORT-for-ICC-Code-Change-Proposal-S74-22-final-2022-06-17.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Same as original proposal.

Public Comment 3:

Proponents: John Williams, representing Committee on Healthcare (ahc@iccsafe.org) requests Disapprove

Commenter's Reason: This proposal has three serious problems.

The added language in the description for Risk Category IV could be read that any of the current occupancies in this list could sustain loss of function as long as that damage did not represent a substantial hazard to the occupants. These are a list of essential facilities that must be operational after an event for the safety and recovery of the entire community. Hospitals that have emergency surgery or emergency treatment facilities need to be operational after an emergency. There could be a lot of damage to the building that would not be a substantial hazard to occupants, but would stop the emergency room from functioning.

If you relocate all nursing homes and hospitals to Risk Category IV with the beginning language - how would you determine what would be a 'substantial hazard' to the occupants. Would this require protection for power and water supplies? What if the windows break? Is that a hazard in the summer or winter? That depends on the season and where in the country you are located. This language will not be uniformly understood or enforced.

This language would move all nursing homes and hospitals to Risk Category IV. Currently nursing homes with between 6 and 50 occupants currently can be Risk Category II; and nursing homes with more than 50 occupants and hospitals without emergency surgery or emergency treatment could be Risk Category III. Yes, this is a vulnerable population. However, there has been no history of issues with these facilities that justifies this increase in design for higher winds, seismic and snow loads for all such facilities. Hospitals and nursing homes already include additional safety features for residents and have a high level of oversite. It the the concern is to remain operational as expressed in the proponents reasons, there are many emergency planning options that can address this outside of a substantial increase in building construction (add cost). These facilities have staff trained in emergency care and operations. If a building has damage, the residents can be relocated to other parts of the building or to another facility. Such facilities typically have emergency generators. Operational plans for emergencies can address early evacuation plans; potable water supplies; etc.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

S75-22

IBC: TABLE 1604.5

Proposed Change as Submitted

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov)

2021 International Building Code

Revise as follows:

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. Group I-3<u>, Condition 1</u> 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 <u>and buildings where loss of function represents a substantial hazard to occupants</u>, including but not limited to: Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. <u>Group I-3 occupancies other than Condition 1.</u> Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: This proposal improves consistency in the assignment of risk categories. It applies current thinking from IBC Chapters 3 and 4 to the risk category assignments in Table 1604.5. The logic of the proposal is as follows:

1. **Risk Category IV is the IBC's main tool to provide functional facilities** soon after a natural hazard event (earthquake, flood, snow, or wind). In terms of post-event functionality, there is a wide gap between RC II-III facilities (which have identical requirements for nonstructural systems) and RC IV facilities. The difference in expected recovery time can be on the order of weeks or months.
2. The performance gap between RC II-III and RC IV is most acute for occupancies that depend on functional nonstructural systems and special design provisions to serve vulnerable users.
3. Because these facilities are rare and specially designed, their services and occupants cannot be quickly relocated to other buildings.
4. Therefore, facilities with special design features and vulnerable users should be strong candidates for Risk Category IV.

Following this logic, this proposal expands the scope of RC IV from just "essential facilities" to include "buildings where loss of function represents a substantial hazard." **This "substantial hazard" can even be life threatening** where, for example, a 24-hour medical facility, residential care facility, public water or power utility, detention center with impeded egress, or critical supply chain facility is out of service for weeks. The code defines *essential facilities* as those that need to "remain operational" through and after an "extreme" earthquake, flood, wind, or snow event. The additional facilities described by the logic above and considered in this proposal might not require continuous operation, but **prolonged downtime – which can be expected from RC II design criteria – can give rise to a similar risk for vulnerable users**, if not on Day 1 after the event, then possibly by Day 3, 10, or 30.

This proposal addresses detention facilities with special security needs, where occupants depend on facility staff for safety and habitability. Group I-3 buildings, currently assigned to RC III, include jails, prisons, and similar facilities in which six or more people are held **"under restraint [and] generally *incapable of self-preservation*."** Group I-3 facilities are also subject to special design requirements in Section 408 for means of egress, fire safety, guard stations, glazing, door mechanisms, etc., making them **essentially unique within a community**. This proposal represents the best way to use current code tools to ensure that a new detention facility will actually be available to serve the community in the days and weeks after a major storm or earthquake.

Existing jails and prisons have a record of life-threatening failures after recent hurricanes (Omorogieva, 2018). So do other old buildings, but the risk to restrained occupants is obviously higher – so much so that it can violate constitutional rights and impose liability on local governments (Jones v. San Francisco, 1997; Omorogieva, 2018). Even if the structure remains safe from collapse – the objective of both RC II and RC III – the loss of power and damage to MEP, communications, and security systems can leave the facility non-functional and, for restrained occupants, uninhabitable to the point of violation (Jones v. San Francisco, 1997). The concern has prompted a current bill in the U.S. Senate seeking information on the preparedness and damage costs in federal correctional facilities after major disasters (S.4748, 2020). The IBC should ensure that new jails and prisons are not adding to the problem.

RC III design provisions for nonstructural systems are the same as for RC II. Most jails and prisons do have emergency plans, and IBC Section 408.4.2 does require emergency power for certain doors and locks. But those strategies are focused on short-term outages or emergency response; they typically do not consider the effects of a long-term outage due to inevitable storm or earthquake damage. Many emergency plans assume feasible evacuation. But pre-event evacuation is only possible for trackable storms, not for earthquakes. Evacuation also comes with high costs and security concerns, requires a facility to evacuate to, and makes no provision for return to a damaged building. Better design can, and should, help solve this problem.

This proposal reassigns four of the five Conditions under Group I-3 to RC IV. Except for Condition 1, which this proposal leaves in RC III, all Group I-3 facilities have **egress and free movement impeded by locks**, rendering the occupants incapable of self-preservation. Because of this restraint, the uniqueness of Group I-3 facilities, and the implications of long repair times, Risk Category IV is appropriate.

Despite this reassignment, this proposal is measured in its scope. **It does NOT affect:**

- Group I-3, Condition 1. These facilities do allow free movement for occupants and are even eligible for design as residential occupancies. (One might argue that these do not even need to be assigned to RC III, but a change to RC II is outside the scope of this proposal.)
- Facilities with fewer than 6 people under restraint. Per Section 308.4, Group I-3 applies only to larger facilities. This would exempt typical holding cells in small court facilities.
- Halfway houses assigned to Group I-1 or R-4. (The difference between "halfway houses," listed in Sections 308.2 and 310.5, and "prerelease centers," listed in Section 308.4, is unclear.)

This proposal is consistent with current IBC principles. This proposal extends the current scope of Risk Category IV, but it does so consistent with the purpose, philosophy, and normative goals the IBC already represents.

Even if you think of the IBC as strictly a "life safety" code, safety is more than mere survival, and safety can be at risk even after the rain, snow, or ground shaking has stopped. If building damage affects the safety of vulnerable users in the following days or weeks, it is consistent with even a safety-based code to manage those risks through design.

But the IBC's purpose is broader than just "life safety." Section 101.3 states that the purpose of the IBC is to provide a "reasonable level of safety, **health and general welfare**." So a focus on the health and welfare of vulnerable building users, even where their building provides immediate safety, is both "reasonable" and completely consistent with the purpose of the code.

With its definition of *essential facilities* and its use of Risk Category IV to ensure they "remain operational," the IBC is already more than a safety code. It is, in fact, already a basic "functional recovery" code; the only question is which building uses, and users, we decide should qualify for a designed recovery. Where RC II or RC III is not reliable enough, it is consistent with the purpose and scope of the IBC to assign more building uses to RC IV.

Not all of the IBC's tools are perfectly nuanced. Some involve bright lines and broad categories, and it is sometimes necessary to err on the conservative side. So even if a certain use is not quite as "essential" as a fire station, RC IV might still be a more appropriate choice than RC II or RC III, and in these cases, it is consistent with the code to assign buildings to the higher category. In time, design criteria should evolve to address more specific recovery objectives (FEMA, 2020; FEMA-NIST, 2021). But those nuanced provisions are *at least* a decade away. For now, however, RC IV is the most appropriate tool we have, and we ought to use it. Adapting existing practices to new objectives is entirely consistent with the history of code development.

IBC Chapters 3 and 4 define and provide special requirements to manage fire and egress risks for particular groups of users. Table 1604.5 is meant to do the same for rare natural hazard events. But while Chapters 3 and 4 consider dozens of specific building uses and conditions, Table 1604.5 has only four categories. Changing the scope of Risk Category IV to account for specific building uses that are not adequately served by RC II or RC III criteria is consistent with the detailed, use-specific approach of Chapters 3 and 4.

Table 1604.5 represents public policy about what we desire from our buildings. As such, it has changed over time, along with public expectations. As we consider new or increasing risks related to more frequent natural hazard events, urbanization, the pandemic, or aging populations, it is both appropriate and consistent with past practice for Table 1604.5 to evolve as well.

Bibliography: Almufti, I. et al. (2016). "The resilience-based design of 181 Fremont Tower," *Structure*, June.
Bade, M. (2014). "Mission Bay Block 25 Building – An Exercise in Lean Target Value Design," Presentation to the Lean Construction Institute, Finland, April 12.

Berkowitz, R. (2021). "UCSF Center for Vision Neuroscience," 2021 EERI Annual Meeting, Session 3B, March 24.

CISA, 2020. "Guidance on the Essential Critical Infrastructure Workforce: Ensuring Community and National Resilience in COVID-19 Response (Version 2.0)." U.S. Department of Homeland Security, Cybersecurity & Infrastructure Security Agency, March 28.

FEMA (2020b). *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures, Volume II: Part 3 Resource Papers*, 2020 Edition, FEMA P-2082-2, prepared by the Building Seismic Safety Council of the National Institute of Buildings Sciences for Federal Emergency Management Agency, September.

FEMA-NIST (2021). *Recommended Options for Improving the Built Environment for Post-Earthquake Reoccupancy and Functional Recovery Time*, FEMA P-2090 / NIST SP-1254, Federal Emergency Management Agency and National Institute of Standards and Technology, January.

Jones v. San Francisco, 1997. Arnold Jones et al. v. City and County of San Francisco, et al., 976 F.Supp. 896, July 18.

Mar, D. (2021). "Making Resilience Affordable," 2021 EERI Annual Meeting, Session 3B, March 24.

Omorogieva, W., 2018. "Prison Preparedness and Legal Obligations to Protect Prisoners During Natural Disasters." Sabin Center for Climate Change Law, Columbia Law School, May.

S.4748, 2020. "Correctional Facility Disaster Preparedness Act of 2020" [S.4748].

SEFT Consulting Group (2015). “Beaverton School District Resilience Planning for High School at South Cooper Mountain and Middle School at Timberland,” SEFT Consulting Group, July 10.

SFDPH, 2020. “Order of the Health Officer No. C19-07b.” City and County of San Francisco, Department of Public Health, March 31, et seq.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction for the buildings newly assigned to RC IV. The largest increases will likely be in high seismic areas where assignment to RC IV makes the largest changes to structural and nonstructural design criteria. This does not mean, however, that every RC IV facility will have the same unit cost as a new state-of-the-art hospital. On the contrary, case studies of voluntary RC IV-like seismic design have found a **construction cost premium ranging typically from 0% to 2%** relative to normal RC II designs. (See proposal references by Almufti, Bade, Berkowitz, Mar, and SEFT.) This estimate stands to reason: Wind, snow, and earthquake loads can already vary significantly within a jurisdiction, but the building designs and unit costs don't change wildly from one side of the county to the other. For example, the seismic design force in Berkeley is about 1.5 times that in downtown San Francisco; so with respect to the structure, any nursing home or grocery store you can build as RC II in Berkeley you can also build as RC IV in San Francisco with no change to the design. The same is likely true for snow design, for example, in Vail v. Boulder and for wind design in Galveston v. the west side of Houston. On the nonstructural side, a facility's nonstructural systems might need more bracing or support when assigned to RC IV, but the number and size of the components themselves don't suddenly look like a hospital just because the risk category has changed.

S75-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as it is important to keep detention facilities with security needs operational as an essential facility. (Vote: 14-0)

S75-22

Individual Consideration Agenda

Public Comment 1:

Proponents: Heidi Tremayne, representing Earthquake Engineering Research Institute (heidi@eeri.org) requests As Submitted

Commenter's Reason: I would like to express SUPPORT for the code change proposal S75-22 on behalf of the Earthquake Engineering Research Institute (EERI). This proposal exemplifies EERI's vision by recommending a clear and important action to improve the International Building Code. Once adopted, this code change will improve the seismic performance of new detention facilities with special security needs assigned to Occupancy Group I-3, in alignment with recommendations from EERI's published policy statements. Thank you for considering EERI's position on this important code issue.

EERI's formal support letter can be viewed at: https://www.cdpaccess.com/public-comment/3343/27372/files/download/3612/EERI-SUPPORT-for-ICC-Code-Change-Proposal-S75-22-final-2022-06-17.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Same as original proposal.

Public Comment# 3343

Public Comment 2:

Proponents: John Williams, representing Committee on Healthcare (ahc@iccsafe.org) requests Disapprove

Commenter's Reason: The scope of the Healthcare committee is for healthcare facilities, such as ambulatory care facilities, clinics, nursing homes and hospitals. Therefore, this public comment is limited to the effect of the new language to the description of Risk Category IV and how it would effect the 1st and 2nd item in the list.

- Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities.
- Ambulatory care facilities having emergency surgery or emergency treatment facilities.

The added language in the description for Risk Category IV could be read that any of the current occupancies in this list could sustain loss of function as long as that damage did not represent a substantial hazard to the occupants. These are a list of essential facilities that must be operational after an event for the safety and recovery of the entire community. Hospitals that have emergency surgery or emergency treatment facilities need to be operational after an emergency. There could be a lot of damage to the building that would not be a substantial hazard to occupants, but would stop the emergency room from functioning.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3057

S76-22

IBC: TABLE 1604.5

Proposed Change as Submitted

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov)

2021 International Building Code

Revise as follows:

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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~~ <u>Public</u> 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 <u>and buildings where loss of function represents a substantial hazard to occupants or users</u>, including but not limited to: Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. <u>Public utility facilities providing power generation, potable water treatment, or wastewater treatment.</u> 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: This proposal improves consistency in the assignment of risk categories. It applies current thinking from IBC Chapters 3 and 4 to the risk category assignments in Table 1604.5. The logic of the proposal is as follows:

1. **Risk Category IV is the IBC's main tool to provide functional facilities** soon after a natural hazard event (earthquake, flood, snow, or wind). In terms of post-event functionality, there is a wide gap between RC II-III facilities (which have identical requirements for nonstructural systems) and RC IV facilities. The difference in expected recovery time can be on the order of weeks or months.
2. The performance gap between RC II-III and RC IV is most acute for occupancies that depend on functional nonstructural systems and special design provisions to serve vulnerable users.
3. Because these facilities are rare and specially designed, their services and occupants cannot be quickly relocated to other buildings.
4. Therefore, facilities with special design features and vulnerable users should be strong candidates for Risk Category IV.

Following this logic, this proposal expands the scope of RC IV from just "essential facilities" to include "buildings where loss of function represents a substantial hazard." **This "substantial hazard" can even be life threatening** where, for example, a 24-hour medical facility, residential care facility, public water or power utility, detention center with impeded egress, or critical supply chain facility is out of service for weeks. The code defines *essential facilities* as those that need to "remain operational" through and after an "extreme" earthquake, flood, wind, or snow event. The additional facilities described by the logic above and considered in this proposal might not require continuous operation, but **prolonged downtime – which can be expected from RC II design criteria – can give rise to a similar risk for vulnerable users**, if not on Day 1 after the event, then possibly by Day 3, 10, or 30.

This proposal addresses buildings that support the operations of public utilities. Under the current code, utility buildings that support power generation and water treatment are mostly assigned to RC III even though their value and function is closely linked to the performance of specialized nonstructural components. Only those that provide "emergency backup facilities" for other RC IV facilities are themselves assigned to RC IV.

Instead of drawing a line between normal operations and "emergency backup," this proposal makes the distinction between public utilities (typically designated not by the code but by a state or local commission) and other utilities. If housing, schools, offices, shops, and all the other normal buildings assigned to RC II are to be unusable for prolonged periods after a major storm or earthquake, it should not be because of a failure at a public water or power utility. On the contrary, a policy that expects people to "shelter in place" for weeks or longer in damaged but occupiable buildings should, at the very least, supply those buildings with water and power within at most a few days.

Further, those who would argue that RC IV design for more buildings should be voluntary must acknowledge that no developer would do that voluntary work until reliable utility services are in place. Otherwise, the voluntary work would be wasted as long as a utility outage continues.

Therefore, this proposal makes the key distinction between public water and power utilities and other utilities as follows:

- It maintains the "emergency backup" utilities in RC IV, with no change to the current code.
- It moves public utility facilities for power generation, potable water, and wastewater from RC III to RC IV.
- It maintains the broad assignment of the remaining public utilities to RC III, essentially as in the current code. In some jurisdictions, these "other public utilities" (in the current code's phrasing) might include communications or public transit facilities, but it is the fact that they are designated as public utilities that qualifies them for design consideration beyond RC II.

Despite this reassignment, this proposal is measured in its scope. **It does NOT affect** any non-public utility or any utility supply chain facility not already included in the current RC III provision.

(The current wording of Table 1604.5 regarding utilities is unclear in several ways, but clarifying or correcting it is outside the scope of this proposal. Examples of unclear wording include: Is it assumed that all power generation and water treatment facilities *are* public utilities? Is a solar installation that returns power to the grid considered "power generation"? Are power distribution facilities included with "power generating stations"? What "other" utility functions does the code expect to be assigned to RC III? Why would public utilities be considered *backup* for private facilities, rather than the primary service? And if there is no backup, shouldn't the primary service be assigned to RC IV as well? How many public utilities serve only RC IV facilities, but not the broader community? Etc.)

This proposal is consistent with current IBC principles. This proposal extends the current scope of Risk Category IV, but it does so consistent with the purpose, philosophy, and normative goals the IBC already represents.

Even if you think of the IBC as strictly a "life safety" code, safety is more than mere survival, and safety can be at risk even after the rain, snow, or ground shaking has stopped. If building damage affects the safety of vulnerable users in the following days or weeks, it is consistent with even a safety-based code to manage those risks through design.

But the IBC's purpose is broader than just "life safety." Section 101.3 states that the purpose of the IBC is to provide a "reasonable level of safety, **health and general welfare**." So a focus on the health and welfare of vulnerable building users, even where their building provides immediate safety, is both "reasonable" and completely consistent with the purpose of the code.

With its definition of *essential facilities* and its use of Risk Category IV to ensure they "remain operational," the IBC is already more than a safety code. It is, in fact, already a basic "functional recovery" code; the only question is which building uses, and users, we decide should qualify for a designed recovery. Where RC II or RC III is not reliable enough, it is consistent with the purpose and scope of the IBC to assign more building uses to RC IV.

Not all of the IBC's tools are perfectly nuanced. Some involve bright lines and broad categories, and it is sometimes necessary to err on the conservative side. So even if a certain use is not quite as "essential" as a fire station, RC IV might still be a more appropriate choice than RC II or RC III, and in these cases, it is consistent with the code to assign buildings to the higher category. In time, design criteria should evolve to address more specific recovery objectives (FEMA, 2020; FEMA-NIST, 2021). But those nuanced provisions are *at least* a decade away. For now, however, RC IV is the most appropriate tool we have, and we ought to use it. Adapting existing practices to new objectives is entirely consistent with the history of code development.

IBC Chapters 3 and 4 define and provide special requirements to manage fire and egress risks for particular groups of users. Table 1604.5 is meant to do the same for rare natural hazard events. But while Chapters 3 and 4 consider dozens of specific building uses and conditions, Table 1604.5 has only four categories. Changing the scope of Risk Category IV to account for specific building uses that are not adequately served by RC II or RC III criteria is consistent with the detailed, use-specific approach of Chapters 3 and 4.

Table 1604.5 represents public policy about what we desire from our buildings. As such, it has changed over time, along with public expectations. As we consider new or increasing risks related to more frequent natural hazard events, urbanization, the pandemic, or aging populations, it is both appropriate and consistent with past practice for Table 1604.5 to evolve as well.

Bibliography: Almufti, I. et al. (2016). "The resilience-based design of 181 Fremont Tower," *Structure*, June.
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FEMA (2020b). *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures, Volume II: Part 3 Resource Papers*, 2020 Edition, FEMA P-2082-2, prepared by the Building Seismic Safety Council of the National Institute of Buildings Sciences for Federal Emergency Management Agency, September.

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Mar, D. (2021). "Making Resilience Affordable," 2021 EERI Annual Meeting, Session 3B, March 24.

SEFT Consulting Group (2015). "Beaverton School District Resilience Planning for High School at South Cooper Mountain and Middle School at Timberland," SEFT Consulting Group, July 10.

SFDPH, 2020. "Order of the Health Officer No. C19-07b." City and County of San Francisco, Department of Public Health, March 31, et seq.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction for the buildings newly assigned to RC IV. The largest increases will likely be in high seismic areas where assignment to RC IV makes the largest changes to structural and nonstructural design criteria. This does not mean, however, that every RC IV facility will have the same unit cost as a new state-of-the-art hospital. On the contrary, case studies of voluntary RC IV-like seismic design have found a **construction cost premium ranging typically from 0% to 2%** relative to normal RC II designs. (See proposal references by

Almufti, Bade, Berkowitz, Mar, and SEFT.) This estimate stands to reason: Wind, snow, and earthquake loads can already vary significantly within a jurisdiction, but the building designs and unit costs don't change wildly from one side of the county to the other. For example, the seismic design force in Berkeley is about 1.5 times that in downtown San Francisco; so with respect to the structure, any nursing home or grocery store you can build as RC II in Berkeley you can also build as RC IV in San Francisco with no change to the design. The same is likely true for snow design, for example, in Vail v. Boulder and for wind design in Galveston v. the west side of Houston. On the nonstructural side, a facility's nonstructural systems might need more bracing or support when assigned to RC IV, but the number and size of the components themselves don't suddenly look like a hospital just because the risk category has changed.

S76-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

TABLE 1604.5 RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

Portions of table not shown remain unchanged.

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000.[a] <u>Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public</u> ~~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 and buildings where loss of function represents a substantial hazard to occupants or users, including but not limited to: Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. Public utility facilities providing power generation, potable water treatment, or wastewater treatment. 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 1004.5 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 that 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.

Committee Reason: Approved as modified as the proposal makes the appropriate distinction between facilities for Risk Category III and IV. For lucidity, the modification restores the current wording for Risk Category III. (Vote: 10-4)

S76-22

Individual Consideration Agenda

Public Comment 1:

Proponents: David Bonowitz, representing Self (dbonowitz@att.net) requests As Modified by Committee

Commenter's Reason: The argument in support of S76 is simple and self-evident: Water and power are vitally important in the hours and days following a damaging earthquake, hurricane, or winter storm. The facilities that provide these services to the public are therefore *essential* and should be assigned to Risk Category IV.
To this obvious truth, the opposition has no response. Instead, they make a number of claims, which we rebut in brief below.

Opposition claim: S76 should be disapproved because it doesn’t define “public utility.”

Rebuttal in support:

-- “Public utility” is already used in the IBC, and S76 uses it with exactly the same meaning and context.

-- It is a simple exercise for any code user or building official to learn that “public utility” means a provider of certain basic products or services – like water and power – for sale to the general public. But the code cannot, and need not, provide a definition, because it is already defined in state and federal statutes. See the supplemental information in the attached file.

-- At the committee action hearings, opposition to S76 showed a surprising misunderstanding of this quite common term. ICC members and voters can avoid that confusion by reviewing the attached supplemental information.

Opposition claim: S76 should be disapproved because it doesn’t define “power-generating station.”

Rebuttal in support:

-- “Power-generating station” is already used in the IBC, and S76 uses it with exactly the same meaning and context. S76 makes no change at all regarding the meaning of “power-generating station,” so this argument is a red herring.

-- At the committee action hearings, the opposition asked whether certain small PV installations qualify as “power-generating stations,” but that question is moot because S76 applies only to “public utilities.”

-- Proposal S81 can, and does, clarify conditions where PV systems that are *not* public utilities might be properly assigned to RC I or II, making this opposition to S76 moot.

-- The lead opposition to S76 is also the proponent of S79 and S81. As noted in the reason statements for S79 and S81, ASCE 7-16 Section 15.5.4.1 states, “Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbo machinery.” The S79 and S81 proponents argue that based on this ASCE 7 provision, the term “power-generating stations” as used in Table 1604.5 (and S76) “was never intended to apply to individual PV panel systems.” If this is correct, then S76 will not affect solar, and the opposition disproves its own claim.

Opposition claim: Most PV is designed as RC I and most wind turbines are designed as RC II, so assignment to RC IV is a huge change.

Rebuttal in support:

-- Public utility facilities – that is, the only facilities affected by S76 – are already assigned to RC III, not RC I or II. See the supporting information regarding the use and definition of “public utility”.

-- The fact that PV vendors have convinced building officials to allow RC I based on safety alone (i.e. because ground mounted or short elevated PV systems can’t kill you by falling on you) shows why S76 is needed, because without it, code users completely ignore the public service nature of a public utility that the current RC III assignment is meant to reflect.

-- Proposal S81 can, and does, clarify conditions where safety – as opposed to service to the public – is an appropriate basis for design. So S81 resolves any confusion about the intent of either the current code or S76.

Opposition claim: Even “utility scale” PV is designed as RC I, so S76 emphasis on “public utility” will change that or is at least confusing.

Rebuttal in support:

-- "Public utility” is the term already used in the IBC. S76 doesn’t change that.

-- “Utility scale” is NOT a term used in either the IBC or S76, so this claim is a red herring.

-- “Utility scale” does not imply “public utility.” See the attached supporting information about the meaning of “public utility.” It has nothing to do with scale. In fact, many large power utilities (including many wind and solar installations) are not public utilities at all.

Opposition claim: S76 disproportionately hurts solar and wind, which use the building code for design, and has less effect on older technologies (steam and combustion turbines), which do not.

Rebuttal in support:

-- S76 does not target any specific industries. Rather, it recognizes the importance of post-event water and power, regardless of fuel source. Neither the current Table 1604.5 nor S76 makes a distinction by fuel source.

-- PV and wind installations that routinely use the building code and are permitted by the local building departments are generally NOT public utilities affected by S76. Rather, they are typically private facilities or municipal utilities; see the supporting information.

-- It is FALSE that older power plant types don't use the building code. If they are owned by government agencies or independent authorities, they might not receive building permits through the local building official, but they do use the building code and its reference standards (like ASCE 7) as technical design guidance for their buildings and non-building structures. Thus, S76 will influence the design of these facilities as well.

-- At the committee action hearings, the opposition also claimed that public utilities do not use the building code. This is plainly false, likely revealing the opponents' misunderstanding of the term "public utility" – a term already used in the building code, as discussed above and in the supporting information.

-- As noted above, the opposition disproves its own claim by citing (in its reason statements for S79 and S81) a provision from ASCE 7 suggesting that "power-generating stations" excludes PV.

Opposition claim: The design requirements that come with RC IV will increase PV and/or wind system costs so much that they will make those systems impossible or infeasible to build.

Rebuttal in support:

-- This is a far-fetched claim belied by the opponent's own arguments. In testimony on S76 and S81, opponents acknowledged that some PV installations are already assigned to RC III or IV per the current IBC, proving that the RC III and RC IV design criteria is feasible.

-- Outside the code hearings, opponents have claimed that RC IV design criteria will make wind turbine towers so large that they cannot be transported to the site. This, too, is belied by the fact that installations do exist in regions with some of the highest wind and seismic design criteria in the country. If you can transport to these (typically coastal) areas under the current code, then you can transport to any location where RC IV criteria under S76 would still be less than current RC IV criteria in the high-demand locations (such as the Great Plains states).

-- S76 affects only public utility facilities, which the current code already assigns to RC III. Therefore, the appropriate comparison is not between RC I and RC IV but between RC III and RC IV. Our analysis of the IBC and ASCE 7 criteria shows that in high seismic areas, the general increase in design forces would be only 20% (1.5/1.25=1.2). In high wind areas, the increase in design wind pressure would be only 9% throughout the Great Plains states where wind power is most common; in coastal areas, the increase would range from 0% in much of Florida to 14% off the North Carolina coast. In none of these cases is the increase infeasible or impossible.

-- Every industry or user group whose facilities have been assigned to RC IV has made the same objection ... and then has moved forward to develop design criteria and to innovate structural solutions to satisfy the policy goals of Table 1604.5. We have full confidence that the PV and wind energy industries, as well as other power and water infrastructure organizations, can and will do the same.

Opposition claim: Risk Category assignment will not improve grid reliability, which is as much about redundancy and network effects as it is about design of individual components.

Rebuttal in support:

-- Table 1604.5 already addresses these utilities and infrastructure with respect to structural design. S76 does not change that.

-- Table 1604.5 is a policy statement, not a technical provision. It is the one place in the IBC where the *purpose* of a proposed building or structure is considered with respect to severe natural hazards. As such, it is entirely appropriate to set policy guidance in Table 1604.5, with the understanding that technical criteria needed to satisfy the policy goals are set elsewhere.

-- At the committee action hearings, opponents referenced the North American Electric Reliability Corporation (NERC) as the appropriate body to set standards for grid reliability. That's great, as Table 1604.5 and the IBC rely on the existence and maintenance of consensus design standards, such as ASCE 7 and those promulgated by NERC. But those standards are not cited from Section 1604.5. A NERC standard for wind and seismic design would be a great contribution, but its performance goals with respect to extreme wind and seismic events should come from the policy guidance in the building code. Even without such a standard, NERC can (and should) develop a consensus statement about the expected reliability and recovery of existing grids and current PV and wind power designs. By doing so, they might even show that current designs are adequate to the purpose of RC IV and should be deemed to comply with S76. If that's the consensus, NERC should be able to produce such a statement even before the 2024 IBC becomes effective in a couple of years.

Opposition claim: S76 should be disapproved because it was proposed by seismic experts, not energy experts.

Rebuttal in support:

-- The FEMA-ATC committee does include seismic design experts, but it also includes structural experts, experts in nonstructural systems and non-building structures, and building code experts generally.

-- Table 1604.5 is within the scope of the structural committee, not the energy committee.-- S76 is largely a policy statement and will be decided, appropriately, by the ICC Structural Committee, which has already approved it, and by building officials considering the needs of their communities.

https://www.cdpaccess.com/public-comment/3432/27577/files/download/3625/S76%20Public%20Utility%20notes.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Same as the original proposal as modified by committee.

Public Comment# 3432

Public Comment 2:

Proponents: Heidi Tremayne, representing Earthquake Engineering Research Institute (heidi@eeri.org) requests As Modified by Committee

Commenter's Reason: I would like to express SUPPORT for the code change proposal S76-22 on behalf of the Earthquake Engineering Research Institute (EERI). This proposal exemplifies EERI's vision by recommending a clear and important action to improve the International Building Code. Once adopted, this code change will improve the seismic performance of new buildings that support operations of public utilities that provide power generation, potable water treatment and wastewater treatment, in alignment with recommendations from EERI's published policy statements. Thank you for considering EERI's position on this important code issue.
EERI's formal support letter can be viewed at: https://www.cdpaccess.com/public-comment/3348/27380/files/download/3613/EERI-SUPPORT-for-ICC-Code-Change-Proposal-S76-22-final-2022-06-17.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Same as original proposal.

Public Comment# 3348

Public Comment 3:

Proponents: David Banks, representing CPP Inc (dbanks@cppwind.com) requests Disapprove

Commenter's Reason: I do not believe that requiring most solar to be RC IV will result in improved overall grid resilience, which I believe is the underlying goal of this proposed change, given the proposal's emphasis on electricity availability soon after a natural hazard event. I certainly support this objective, but this proposal is the wrong approach. This is like increasing airplane safety by requiring all planes be too heavily reinforced to take flight. This would have extinguished the industry.
Instead, the aerospace industry ensures high reliability because parts and materials are subject to stringent quality control and strict preventative maintenance schedules, and all failures are subject to intense scrutiny. We should similarly tailor resilience solutions for solar. As an author of SEAOC PV2 and the draft ASCE Solar Manual of Practice, I know it takes time, effort and expertise to ensure resilient design is promoted. More support for such targeted efforts is needed.

As a Principal at CPP wind engineering, I have consulted on hundreds of solar products and projects. I've spent the last 14 years working to understand the risk of wind damage to solar. Using RCIV would not have prevented most of the wind-related failures I have seen. If designers are unaware of a load effect (such as aeroelastic instability or certain companion loads), increasing the magnitude of all the other design loads will, at best, fix the problem by accident.

In the absence of SB76-22 there is nothing to prevent local AHJs and others from requiring RCIII or RCIV speeds as needed for specific solar projects, particularly in places where other electricity sources are very expensive or the impact of a failure is unusually high. This is being done in Puerto Rico right now. Only a small subset of the available racking systems can be built there as a result, though. Unless S81-22 passes, S76-22 would eliminate many current racking systems from consideration and reduce the adoption of solar across the country.

If we are to accept such a cost, the necessity should be a clearly explained as part of the grid reliability guidance from FERC and NERC. I sincerely doubt that requirements in the IBC are the best way to implement their electricity resilience policy. But if IBC changes are indeed the only way, such provisions should reflect consultation with stakeholders to craft something with consideration for potential unintended consequences. I don't expect the transition will be smooth if this proposal passes.

It would be sadly ironic if a measure intended to reduce the impact of ever-increasing natural hazards significantly reduces adoption of solar energy. I recommend this heavy-handed proposal be disapproved.

Bibliography: None.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

As my comment advocates disapproving the code change proposal, there would be no cost impacts if my recommendation was put into effect.

Public Comment# 3269

Public Comment 4:

Proponents: Michael Bergey, representing Distributed Wind Energy Association (mbergey@bergey.com) requests Disapprove

Commenter's Reason: S76-22-BONOWITZ-3 would mandate that "Public utility facilities providing power generation …" be designed under Risk Category IV. The Distributed Wind Energy Association (DWEA) opposes this proposal and recommends that it be disapproved.
Rationale:

· DWEA represents the industry that provides wind turbines for "behind-the-meter" applications. This might be a 5-kW turbine for a rural residence or a 2-MW turbine for an industrial facility. Our members installations require building permits and are typically required to meet the IBC or one of its derivatives.

· DWEA recognizes the beneficial intent of S76 and does not disagree with the proponents that the structures related to critical public services should be designed to more robust standards as a compliment to the more robust standards for critical structures.

· The proponent's intent, as expressed in documents and testimony, is to subject only public utilities to the upgrade to RC IV.

· The term "Public utility facilities", however, is not adequately defined to avoid overly conservative interpretation by code officials. For example:

o Since even a small residential wind turbine will transmit excess power generation to the grid and receive compensation for it, it would be difficult for a homeowner to prove that they were not some form of a public utility.

· Most distributed wind systems are evaluated under RC II and upgrading to RC IV would increase foundation costs significantly (see below) and prohibit the use of standard towers in many coastal zones.

· In the case where a distributed wind system is part of a microgrid system (including energy storage) that serves an RC IV facility we believe the application of RC IV to the wind turbine support structure and foundation is appropriate.

Note: DWEA supports the comments and edits submitted on S79 by the American Clean Power Association (ACPA), which we believe would meet the intent of the S76 proponents without disadvantaging the vast majority of the distributed wind projects.Note: DWEA evaluated residential-scale towers and foundations for self-supporting lattice towers for RC II and RC IV for 110, 120 and 140 mph basic wind speeds per TIA 222-H using the industry standard tnxTower analysis tool. We found that loads increased by an average of 16% and total installed turbine costs increased by an average of 6%. It's worth noting that manufacturers will spend years of research and hundreds of thousands of dollars to shave installed costs a few percent, so a 6% increase is significant. Also, since there has not been a history of tower and foundation failures, the value of stronger foundations to the customer is diminimus. More importantly, our analyses revealed that standard RC II towers would not satisfy TIA-222-H in coastal areas under RC IV. We estimate that the "heavy-duty" towers required would add a further 7% to the installed cost.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to the code.

Public Comment# 3363

Public Comment 5:

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests Disapprove

Commenter's Reason: The Solar Energy Industries Association (SEIA) is seeking Disapproval of Proposal S76-22 by FEMA-ATC SCSC for multiple reasons.
1. Proposal S76-22 does not solve the problem the proponents are attempting to solve.

2. S76-22 has flawed language that is undefined, ambiguous, and conflicting.

3. S76-22 amplifies the undefined and ambiguous terms "power generating station" and "public utility facility" in a way that many AHJs will be unable to interpret, so many will likely just choose the most restrictive interpretation and require Risk Category IV.

4. S76-22 selectively and disproportionately disadvantages clean, renewable energy.

5. S76-22 could have the opposite effect for the grid – slowing gains in grid reliability.

6. The structural behavior of renewable energy facilities is very different from “conventional” turbine-based power generating stations for which the Risk Category table was written.

7. Reliability of the grid is not within the Scope of the IBC, nor within the responsibility of Structural Engineers or developers of the IBC.

8. The U.S. Department of Energy has spent over a decade working on driving down the cost of renewable energy, along with improving performance; S76-22 by FEMA threatens to drive the cost of renewable energy right back up without improving performance.

Proposal S76-22 does not solve the problem the proponents are attempting to solve.

The proponents of S76-22 seem primarily interested in functional recovery of building structures. We should all be able to agree that we want buildings and communities with greater resilience, and we should all be able to agree that we want our grid to be more reliable.

Proposal S76-22 does not solve or even contribute to any of these goals. It does not solve the problem the proponents are trying to solve. The proponents and supporters mentioned power outages in Texas, California, and from SuperStorm Sandy. The root causes of these power outages have been studied and identified. None of these events would have benefited -- none of these power outages would have been prevented -- by simply imposing the additional cost of higher Risk Categories.

The proponents seem to believe that increasing the risk category – and therefore seismic, wind, snow, ice, and flood loads – of power generators supplying electrons to the grid will have a direct return of a more-reliable supply of electrons to the building structures they are interested in for functional recovery. It will not. As substations, step-up transformers, transmissions towers and high-voltage lines are outside the scope of the IBC, none of these elements will be improved by changes to the RC table.

If the proponents want building structures to have electrical power to remain operational in the event of extreme environmental events or grid outages, the proponents could be much more direct and much more successful advocating for on-site renewable energy systems paired with on-site battery energy storage systems, with equipment and logic to allow these systems to disconnect from the grid and power the building during periods of grid outages. This would be a direct and smart approach to solving the problem.

S76-22 has flawed language that is undefined, ambiguous, and conflicting.

The proponents have elevated the undefined term “public utility facility” as the primary characteristic for assigning RC IV or RC III. The proponents offer no definition in this proposal. In verbal testimony, one proponent offered a verbal suggestion that if a particular facility is under the control of a public utilities commission, then it is a public utility facility. At a different point in testimony, that same proponent offered a different verbal definition, suggesting that "if it serves the public," then it is a public utility facility. Issues of assigning risk category to a project are far too important – and far too impactful – to be left to conflicting verbal “definitions” by one proponent at a code hearing.

In fact, in the As Modified version of S76-22 as approved by the Structural Committee, there is ambiguity and confusion in the language itself. In the As Modified version:

RC III includes: “Power-generating stations … and other public utility facilities … ”

RC IV includes: “Public utility facilities providing power generation …”

How are these different? The language is flawed and must be disapproved.

S76-22 selectively and disproportionately disadvantages clean, renewable energy.

Many renewable energy projects such as solar and wind are developed and constructed by private interests that must apply for permits through a local County building department. County building departments adopt the IBC, so those private developers and their investors must follow the IBC.

However, Investor-Owned Utilities (IOUs) are not subject to County jurisdiction and do not use the IBC or the National Electrical Code. They use the National Electrical Safety Code (NESC), which is not adopted by building departments. Therefore, while renewable energy facilities would be held to using greatly increased structural loads and associated additional expense, the IOUs would not be held to using higher loads for their “conventional” facilities or for their renewable energy development.

The result is that private developers – and their investors – would be selectively disadvantaged, slowing development of renewable energy facilities.

S76-22 could have the opposite effect for the grid – slowing gains in grid reliability.

Distributed renewable energy sources are spread out and less concentrated in one geographic area. By adding these smaller resources at multiple locations, the reliability of the grid is improved. Many smaller distributed facilities are highly unlikely to experience the same extreme environmental loads at the same time. Disadvantaging renewable energy resources will slow deployment and slow these improvements in reliability.

The structural behavior of renewable energy facilities is very different from “conventional” turbine-based power generating stations for which the Risk Category table was written.

ASCE 7-22 Section 15.5.4 states: “Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbomachinery.” The Risk Category table was written for these very large generators, where a power outage represents a major loss of power generating capacity. For example, Diablo Canyon in California has two reactors with total output of 2.55 GigaWatts. If one or both reactors are shut down, that is a massive loss of power generation.

Renewable energy facilities do not behave this way. Where structural damage has occurred the damage has been localized and did not result in the loss of all power production. These facilities are not “switched on” and “switched off” when there is an environmental event. Damage causing the shut-down of one inverter or one wind turbine does not shut down the entire facility. A very recent anecdote was a photo of a missile strike on a ground-mounted PV system in Ukraine. The photo showed localized damage in the vicinity of the crater, and the rest of the PV facility was still standing.

Reliability of the grid is not within the Scope of the IBC, nor within the responsibility of Structural Engineers or developers of the IBC.

Reliability of the grid is the responsibility of the grid experts at the North American Electric Reliability Corporation, which in turn answers to the United States of America Federal Energy Regulatory Commission. There we find grid experts continually working on reliability of the U.S. grid. There is ongoing work on smart grids, microgrids and other strategies for resilience. We are unaware of any study or document from any of these grid experts that suggest a need for increases in RC of renewable power generation.

The U.S. Department of Energy has spent over a decade working on driving down the cost of renewable energy, along with improving performance; S76-22 by FEMA threatens to drive the cost of renewable energy right back up without improving performance.

The DOE has been funding research projects for over a decade to improve performance, lower cost, and increase deployment of clean, renewable energy systems. As PV modules (such as panels) and inverters are the two highest-cost items, much of this research work has been for driving down the “Balance of System” (BOS) cost, which includes rack systems, trackers, and foundations.

The S76-22 proposal by FEMA threatens to counteract the work of the U.S. DOE by driving cost back up without any increase in performance, and without any substantiating study relating to any need for higher risk categories for solar and wind projects. This is not a smart approach or a targeted approach, and it is not supported by any specific research study. It takes only minutes to write a sentence or two in a code change proposal to work against over a decade of progress by the DOE in research partnerships with industry and other experts, including experts from our national laboratories such as the National Renewable Energy Laboratory (NREL).

No problems are solved by simply increasing all seismic loads, wind loads, and snow loads without any consideration of a targeted approach to solving real problems that are known identified risks. For example, if PV modules have come loose, that means we need to focus on module attachment methods – it does not mean we need bigger and deeper foundations.

We respectfully request disapproval of S76-22. It increases cost, slows deployment, and does not solve any problems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3512

Public Comment 6:

Proponents: Gregory Cooper, representing Renewable Energy (gregory.cooper@ge.com) requests Disapprove

Commenter's Reason: On behalf of the GE team working on Department of Energy (DOE) cooperative agreement DE-EE0009059 we oppose the proposal S76-22 due to the unintended consequences on wind turbine tower and foundation designs. We strongly encourage the rejection of the S76-22 proposal.
Background & Justification;

GE has been awarded a grant from the DOE – EERE under DOE cooperative agreement DE-EE0009059, this award funds the development of a new tower technology to economically increase hub height. This proposed change to the IBC risk category for wind turbines would be a significant setback to our goal of improving wind turbine economics and expanding wind markets in the US.

The DOE funding opportunity (A) associated with DE-EE0009059 has two specific objectives;

1. Reduce the levelized cost of energy (LCOE) of land-based wind power by enabling validation of taller tower technology and capturing stronger wind resources
2. Increase wind turbine deployment opportunities in lower wind speed regions across the country where wind energy has previously been more expensive to deploy.

The DOE funding opportunity (A) also references the current economics stating that under current market conditions, technical innovations will be required for land-based tower heights beyond 120 meters to be economical, since the installed cost increases faster than the increased energy production for most sites.

The impact of the changes proposed in S76-22 would be;

1. Reduction in the max economical hub height from 120m to 100m using existing tower technologies on current wind turbines in the market.
2. Increased program cost and development cycle time for the technology development program under DE-EE0009059 due to this change in requirements.
3. Increase in the cost of the commercial tower technology and reducing the economic benefit being developed under DE-EE0009059.
4. Reduced potential market size in the US where this new technology was considered to be a benefit.

Overall this S76-22 proposal would hinder progress of the wind industry and slow the energy transition in the US. We would encourage the proponents to revisit other means to increase the resilience of our energy systems. We are also confident that other energy system integration improvements could meet or exceed the objectives of this proposal without increasing the cost of wind turbine structures.

Thanks for your consideration.

Greg Cooper – GE Technology Integration Leader

Principal Investigator on DE-EE0009059

Bibliography: (A) EERE Funding Opportunity, DE-FOA-0002071 Area of Interest 4 Tall Towers for U.S. Wind Power
https://eere-exchange.energy.gov/Default.aspx?Search=DE-FOA-0002071&SearchType=

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3229

Public Comment 7:

Proponents: Michael Faraone, representing TerraSmart; James Cormican, representing Terrasmart, Inc. (jcormican@terrasmart.com); Michael Slack, representing Terrasmart (mslack@terrasmart.com) requests Disapprove

Commenter's Reason: My name is Michael Faraone and I disagree with S76-22's proposal which would result in increasing the Risk Category requirement for ground-mounted photovoltaic, PV, arrays. I am the Director of Engineering for TerraSmart, one of the largest PV mounting system manufactures for ground mounted solar in the United States. I have personally worked on almost 4 Gigawatts of PV projects where 97% of them were designed to Risk Category 1. Additionally, my company has worked on a total of 19 Gigawatts of PV arrays where majority are designed to Risk Category 1. The proposed requirement of increasing the Risk Category would result in ground mounts needing to be designed with larger steel structural members, increasing the size and number of foundations. This would result in cost increases to the structure of up to 30% in some cases. For the vast majority of cases, large ground mounted solar PV arrays, Risk Category 1 is appropriate. This can be attributed to design life of the structure, 20-35 years, and the redundant nature of the power arrays having individual strings of solar PV modules spread over acres of land. Most ground mounted solar PV arrays are behind fencing with access only for qualified persons, and no staff on site, representing low risk to human life in the event of a failure. Increasing Risk Category would change the loading calculations, but would not change the solar PV modules themselves, as many would not be rated for higher loading scenarios as required by increased Risk Category, nor would it change the common methods for fastening solar PV modules to the mounting systems. This proposal would add costs that do not improve safety, system reliability, or grid resilience. There are Department of Energy programs working in conjunction with national laboratories such as NREL and others that are specifically targeting solar PV fastener & bolted joint connection performance and reliability. This program and others from ASCE are seeking to improve solar PV safety, reliability, and resilience with targeted efforts involving industry stakeholders. We do not support proposal S76-22 because it is not targeted specifically to ground mounted solar PV, does not involve the input of solar PV industry stakeholders, and ultimately will not achieve the added safety, reliability, and resiliency that I believe the proponents are seeking.

In conclusion myself and TerraSmart oppose S76-22, as this proposal would be detrimental to cost and future viability of PV arrays. Instead of increasing safety, system reliability and grid resiliency, increasing Risk Category would add costs without improving any of those things, reducing new system construction and reducing the number of PV modules available for use in large scale ground mounted solar PV arrays because of significantly higher loading requirements. We oppose this proposal because it would result in the unnecessary overbuilding of the vast majority of ground mounted solar PV arrays, which would mean fewer new arrays being built, and no appreciable improvements to reliability and safety to show for it.

Michael Faraone PH.D., P.E.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3463

Public Comment 8:

Proponents: Daniel Fisher, representing Orie2 Engineering requests Disapprove

Commenter's Reason: Ground mount solar should be considered low risk to human life, Risk Category I. For several reasons, the proposal to increase the risk category of ground mount solar systems should not be approved:

1. Solar panel manufacturer's do not manufacture solar panels that provide sufficient wind pressure capacity to meet the required wind demands caused by increasing the risk category. This, at minimum, should cause the code committee to pause consideration of modifying the risk category until it can be confirmed that it can be implemented into the panel itself. If solar panels cannot resist the demand loads, it could pause the entire industry and would not help with building more sustainable energy system and thus would not be helpful in improving the reliability of the power grid.

2. Structural systems of ground mounted solar fields are inherently redundant: a) Larger fields of solar have thousands to hundreds of thousands of pile (or other types) foundations. It is expected that, in reality, the high, rarely occurring wind gust events prescribed by code will be localized and would not happen to the entire site over tens or hundreds of acres. b) if an area of solar were to be damaged, it would not necessarily cause the entire solar field to go down. A study of how solar would be impacted by localized failure should be considered before voting on a general code requirement such as this. Intelligent electrical design of the solar system could allow the remaining undamaged portion of the site to continue operating when localized failure occurs.

3. An increased risk category could have unintended consequences (i.e. electrical, fire, structural, etc. code impacts). A vote on this topic should be considered to be delayed to study all possible impacts.

4. Risk category of the solar field facility itself should be considered low. The typical installation is fenced in with little to no access by the public and considered a low risk to human life. One argument for an increased risk category is that the power may serve essential facilities, however, the solar power itself is not able to be supplied when the sun is not out (at night) and output is lessened when it is cloudy. One could argue that a better strategy to increasing the reliability of power to the grid is to provide additional solar rather than increasing costs and barriers to installing solar that would be associated with higher risk categories. Power outages that we experience in our area of San Diego are typically associated with high winds and fire dangers, which would occur regardless of the source of power.

5. For battery storage, those facilities (battery containers, etc) could be designed at an increased risk category and sometimes are, but not the solar ground mount system. Neither solar nor battery storage should be considered as a constant supply of power, that is not impacted by weather conditions. At night, solar does not generate power. Therefore, power cannot be fed to the battery from the solar at night, directly or indirectly.

6. A more in-depth study of cost impacts should be considered. Based on feedback from other engineers, most engineers disagree with this proposal, yet the proposal has a significant impact on project cost. Structural costs alone could increase more than 10 to 20% making these projects less economically feasible.

7. Any proposals to directly assign risk category to solar, for the reasons above, should be assigning a risk category of RC=I to the ground mount solar.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3412

Public Comment 9:

Proponents: Karl Schadlich, representing Signal Energy requests Disapprove

Commenter's Reason: In response to proposal S76-22 I am seeking disapproval for the proposed change for Power-generating station and public utility facilities to be required to be designed to Risk Category IV. As a contractor in the renewable energy industry this proposed change does not consider industry specific applications, uses or implications which results in an inaccurate representation towards the intent of the building risk category structure, and impacts the mission and intent what renewable energy facilities are.

1. Proposal S76-22 presents the argument that increasing the risk categories will bolster recovery time “on the order of weeks to months”. It is not clear on what basis this claim is made. Sure, the design would be more conservative and the Mean Recurrence Interval for events will increase, but that doesn’t mean that damage won’t be sustained, and when damage is sustained, the materials are all sourced from common areas and subject to the same manufacturing timelines (if not longer) than the rest of the industry undergoing new construction.

a. Utility Solar and Wind projects take up very large footprints (+1000 acres) compared to their base load generator counterparts and adverse events that cause damage tend to do so in isolated areas meaning that the entire facility is not necessarily brought offline in the instance of an adverse weather event.

2. Renewable energy facilities rely on the resources they are designed for (i.e., sun, wind) and fundamentally those resources are not constant. This means that renewable energy resources are designed and operated as asynchronous/discontinuous power generators that dispatch power over intermittent periods, and further cannot generate power over a continuous 24-hour period.

a. Power generation facilities are further classified into base load plant and peak load classifications. Peak load facilities are intended to supplement base load generation on an electrical grid, and are not intended, modeled, or capable of the support a base load generator provides.

b. Peak load facilities do not support the total capacity that a base load facility would hold so more are required over any given region to balance the base load facilities capacity.

i. To note 1 a above, with the likelihood of isolated damage and a demand on peak generators capacity to be equivalent to the base load, the probability of not having a renewable energy facility online to support some grid demand is highly unlikely considering adverse events cover relatively smaller areas when compared to the size of the transmission network they support.

3. Solar and Wind facilities are non-occupied facilities designed to be operated by a small handful of operations and maintenance personnel that are only present on-site during periods of maintenance and testing. Therefore, renewable energy facilities do not require 24/7 operations support or facilities and can be operated and controlled remotely. Further, the facilities are designed with security fencing which prevents public access, and they are commonly located in remote areas. In instances where renewable energy facilities are located closer to public areas, the security measures are increased and building risk categories are also generally increased to enhance public safety in extreme events.

a. Solar and Wind facilities are mechanical structures not designed or capable or hosting occupants

b. Solar and Wind facilities do not have operations centers and are commonly controlled remotely via independent power provider or Public Utility operations facilities regionally located.

4. Proposal S76-22 indicates that the proposal would result in cost increases to construction. While the cost of construction would be a definite it’s important to note the residual impacts that result from the primary increase to the cost of construction. From a historical project in CA analyzed approximately 2 years ago my team investigated an increase from risk category 1 to risk category 3 resulting in a 40%+ increase to the solar panel racking structure foundation sizing for W6 galvanized I-beams alone. For context, on a 100MW solar project the result was an approximate 1100 ton increase in foundation steel alone. This means that mandating an increase in the building risk category requirements will contribute to:

a. An accelerated increase in carbon emissions

b. An increased burden on public infrastructure, maintenance and reduced overall design life of such public infrastructure (most notably roads and highways).

c. An accelerated depletion in raw materials.A substantial portion to the increase in adverse events correlates directly to global warming, and all the factors described in this section above directly contribute to global warming. It’s unreasonable to approach a problem resulting from climate change that will increase contribution to climate change.

The proposed code change would effect the cost of construction through:

1. increased structural material sizing
2. reduction in overall renewable energy projects since products may not support the design requirements by region.
    1. This will likely increase overall cost of energy
3. increase in major equipment pricing
4. increased logistics and transportation pricing
5. increased duration of construction and operation of equipment for larger structures and components (more fasteners, thicker framing, more

concrete, heavier steel all taking longer to install)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3420

Public Comment 10:

Proponents: Brian Skourup, representing EVS, Inc. (bskourup@evs-eng.com) requests Disapprove

Commenter's Reason: The proposed change could re-assign ground-mounted PV panel systems (GMPVPS) to Risk Category III or Risk Category IV, increasing cost, reducing the total amount of solar generation deployed, and thereby reduce power-generation reliability. The following argument demonstrates that GMPVPS are adequately designed on a risk-targeted basis as Risk Category I structures.
GMPVPS should remain assigned to Risk Category I to maintain the most accurate relationship to existing building code-defined target reliabilities and to avoid excessive conservatism and financial penalties commensurate with assignment to Risk Category II. The risk category selection assigns structures to a defined target reliability/probability of failure also accounting for a failure "basis", i.e. – ductile, brittle, or brittle with progressive collapse (Table 1). For seismic design, Risk Category I and II are equivalent in all respects under current code provisions. For wind design, each risk category corresponds to a different reference period (service life) with a targeted constant design event exceedance probability across all risk categories and reference periods.

Table 1. (Reproduced from ASCE/SEI 7-16, p. 2)

Table 1.3-1 Target Reliability (Annual Probability of Failure, P_F) and Associated Reliability Indices (β)[1] for Load Conditions That Do Not Include Earthquake, Tsunami, or Extraordinary Events[2]

	Risk Category			
Basis	**I**	**II**	**III**	**IV**
Failure that is not sudden and does not lead to widespread progression of damage	$P_F = 1.25 \times 10^{-4}$/yr $\beta = 2.5$	$P_F = 3.0 \times 10^{-5}$/yr $\beta = 3.0$	$P_F = 1.25 \times 10^{-5}$/yr $\beta = 3.25$	$P_F = 5.0 \times 10^{-6}$/yr $\beta = 3.5$
Failure that is either sudden or leads to widespread progression of damage	$P_F = 3.0 \times 10^{-5}$/yr $\beta = 3.0$	$P_F = 5.0 \times 10^{-6}$/yr $\beta = 3.5$	$P_F = 2.0 \times 10^{-6}$/yr $\beta = 3.75$	$P_F = 7.0 \times 10^{-7}$/yr $\beta = 4.0$
Failure that is sudden and results in widespread progression of damage	$P_F = 5.0 \times 10^{-6}$/yr $\beta = 3.5$	$P_F = 7.0 \times 10^{-7}$/yr $\beta = 4.0$	$P_F = 2.5 \times 10^{-7}$/yr $\beta = 4.25$	$P_F = 1.0 \times 10^{-7}$/yr $\beta = 4.5$

[1]The target reliability indices are provided for a 50-year reference period, and the probabilities of failure have been annualized. The equations presented in Section 2.3.6 are based on reliability indices for 50 years because the load combination requirements in Section 2.3.2 are based on the maximum loads for the 50-year reference period.
[2]Commentary to Section 2.5 includes references to publications that describe the historic development of these target reliabilities.

The cumulative probability of exceedance for environmental loads is the basis for structural safety. The formal relationship between the probability of failure, and the probability of exceedance is given below. If *F* is a failure event and *A* is the probability that the design event occurs, the probability of failure, P_f, due to event *A* is given by:

$Pf = P(F|A)P(A)$

Where $P(F|A)$ is the conditional probability of structural failure and $P(A)$ is the probability of exceedance for the design event. See ASCE/SEI 7-16 **C2.5 LOAD COMBINATIONS FOR EXTRAORDINARY EVENTS** (p. 422) for additional commentary. It is clear that $P(F|A) \leq 1.0$ and the upper limit for $P_F = P(A)$. Accordingly, the probability of structural failure cannot exceed the probability of occurrence/exceedance for the design event.For seismic design, the risk-targeted Maximum Considered Earthquake (MCE_R) Ground Motion is defined as, in part, an event with a 2% probability of exceedance within a 50-year period (p. 206 ASCE 7-16). This event corresponds to a mean recurrence interval (MRI) = 2,475 years. The risk category assignment dictates prescriptive detailing requirements and amplified design forces for Risk Categories III and IV. Structures assigned to Risk Categories I and II are treated equivalently under current code provisions.

The risk-targeted design wind speeds are similarly based on a target probability of exceedance within a fixed reference period. However, the reference period and wind speeds vary according to each of the four risk categories. Table 2 illustrates the relationship between risk category, annual probability of exceedance, MRI, and the cumulative probability of exceedance for a structure for each reference period.

The probability of a wind speed exceeding the basic mapped wind speed at least once during the reference period is illustrated below the *Reference Period* title. It should be clear that the target cumulative probability of exceedance is between 5% and 8%, which is relatively constant across the four risk categories and reference periods. These values are presented in **bold** font within the table. However, note that the probability of failure in most cases is less than this value as was previously discussed.

Table 2. Probabilities of Exceeding Wind Loads[1]

Risk Category	*Annual Probability*	*MRI (yrs)*	*Reference Period (years)* 25	50	100	156
I	0.003330	300	**8.0%**	15.4%	28.4%	40.6%
III	0.001430	699	3.5%	**6.9%**	13.3%	20.0%
III	0.000588	1701	1.5%	2.9%	**5.7%**	8.8%
IV	0.000333	3003	0.8%	1.7%	3.3%	**5.1%**

1. Expanded form of Table G3.1 in Guide to the Wind Load Provisions of ASCE 7-16.

GMPVPS are typically designed for a 25-year service life based on the PV panel productive life and manufacturer performance warranty. The current design wind speed and target reliability for structures assigned to Risk Category I correspond to a 25-year reference period. Some manufacturers are already extending panel service lives beyond 25 years, but in no case do warranties or service lives meet or exceed 50 years.

GMPVPS with service lives greater than 25 years should be designed for wind speeds corresponding to their expected service life. These design wind speeds can be obtained following the procedure used by the ASCE 7 Wind Load Task Committee described by Vickery, et al (2010). The resulting values for several reference periods are tabulated here (Table 3) for reference. The coefficients in the "V_{ULT}/V_{50}" column can be applied to any MRI 50-year wind speed (V_{50}) obtained from a design map or other reference, such as the ATC Hazards web tool, to obtain risk-targeted design wind speeds at any location for the reference periods shown. Additionally, the risk-targeted design wind speeds can be computed for any reference period and are not limited to the periods shown here.

Table 3. Design Wind Speeds for Several Reference Periods

Risk Category	*Reference Period (yrs)*	*MRI (yrs)*	*V_{ULT}/V_{50}*	*V_{ULT} (mph)**
I	**25**	**300**	1.179	**106**
	30	371	1.200	108
	35	451	1.220	110
	40	533	1.236	111
II	**50**	**700**	1.264	**114**
III	**100**	**1700**	1.352	**122**
IV	**156**	**3000**	1.409	**127**

**V_{50} = 90 mph*

Table 4 recreates the first three columns of Table 3 but shows the percent error in design wind force for each reference period relative to both Risk Category I and Risk Category II. In the former case, the percentage indicates how much the risk-targeted design wind force is understated for a structure with reference period greater than 25 years while the latter case indicates how much this quantity is overstated. For example, a structure with a 35-year service life assigned to Risk Category I would be under-designed for the risk-targeted wind force by 6.6% while the same structure assigned to Risk Category II would be over-designed for the risk-targeted wind force by 7.4%. In this case, the percentage over-design is also a first-order approximation for the structural cost penalty associated with assigning GMPVPS to Risk Category II.

Table 4. Risk-targeted Wind Forces for Several Reference Periods

Risk Category	*Reference Period (yrs)*	*MRI (yrs)*	*Percentage increase in wind force* Risk Category I*	*Risk Category II***
I	**25**	**300**	0.0%	14.9%
	30	371	3.5%	10.9%
	35	451	6.6%	7.4%
	40	533	9.1%	4.4%
II	**50**	**700**	13.0%	0.0%
			**RC I forces result in understating risk-targeted wind force*	***RC II forces result in overstating risk-targeted wind force*

There is no risk-targeted basis for moving GMPVPS to risk category II, but the change imposes unnecessary inefficiencies and increased costs on all GMPVPS. GMPVPS with extended performance warranties and service lives can either be electively assigned to RC II or designed for wind loads adjusted to the correct reference period. It would be an error to assign all GMPVPS to RC II as the structures are penalized with the burden of excessive design wind forces and increased cost without commensurate benefit. The conclusion being that GMPVPS belong to Risk Category I with the recognition that service lives exceeding 25 years can and should be designed for a risk-targeted wind speed corresponding to an identical reference period.

Bibliography: ASCE. (2016). "Minimum Design Loads for Buildings and Other Structures." *ASCE 7-16.* Reston, VA.
Coulbourne, W. L., and Stafford, T. E. (2020). "Wind Loads - Guide to the Wind Load Provisions of ASCE 7-16." *ASCE Press.* Reston, VA.

Vickery, P. J, Wadhera, D., Galsworthy, J., Peterka, J. A., Irwin P. A., and Griffis, L. A. (2010). “Ultimate Wind Load Design Gust Wind Speeds in the United States for Use in ASCE-7.” *J. Struct. Eng.*, 136(5), 613-625.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3429

Public Comment 11:

Proponents: Trevor Taylor, representing Vestas American Wind Technology (trtay@vestas.com); Christof Dittmar, Siemens Gamesa Renewable Energy, representing Siemens Gamesa Renewable Energy; Toby Gillespie, representing GE Renewables North America, LLC (toby.gillespie@ge.com) requests Disapprove

Commenter's Reason: S76-22 proposes to increase the risk category for “public utility facilities providing power generation” to Risk Category IV (RC-IV). Whether “public utility” is locally defined or not, the proposed modifications could readily be interpreted to encompass wind turbine support structures, which introduces significant, unnecessary, and unjustifiable long-term development and permitting risks to future new and repower (turbine upgrade) renewable wind energy projects across the United States. Delays and cancellations of wind energy projects will unfortunately undermine, not enhance, proponent efforts to bolster resiliency and achieve community functional recovery objectives. Accordingly, GE Renewables North America, LLC., Vestas American Wind Technology, and Siemens Gamesa Renewable Energy (collectively, “OEMs”), representing the three largest manufacturers of onshore wind turbines and towers installed in the United States, recommend that S76-22 be disapproved.The primary purpose of this public comment is to provide specialized background information that explains 1) why S76-22 introduces significant but unnecessary risk into the wind energy permitting process, and 2) emphasizes how RC-IV design load levels cannot in most situations be reconciled by OEMs against existing onerous transportation infrastructure restrictions to develop economically viable towers required for projects.
Justification Statement:

WIND TURBINE SUPPORT STRUCTURE PERMITTING

Wind turbine tower and foundation support structures for U.S. wind energy projects are, in virtually all cases, permitted by local building departments and local Authorities Having Jurisdiction (AHJ) in accordance with International Building Code (IBC) and ASCE/SEI 7 load levels corresponding to Risk Category II (RC-II). This standard wind industry practice extends even before December 2011, when a joint committee of interested parties of diverse stakeholders developed through a consensus process *ASCE/AWEA RP2011, Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures* (RP2011). Section 4.4 of RP2011 provides justification for standard classification under Occupancy Category II of ASCE 7. Although the term “Occupancy Category” has evolved into “Risk Category” in ASCE 7 and the IBC to encompass a broader definition of risks associated with structural failure since RP2011 was published, the general classification and associated “normal/standard structure” building code design load importance factors have remained the same. Wind tower and foundation engineering practitioners and wind energy project permitting AHJ’s continue to reference RC-II load levels for design/verification today as standard industry practice.

It is reasonable and logical under closer scrutiny for wind energy engineering stakeholders to continue referencing RC-II load levels in the future.

Unfortunately, proposed S76-22 introduces uncertainty in wind turbine support structure Risk Category classification for which reasonable and expeditious project permitting depends. S76-22 attempts to establish a well-intended but insufficiently detailed policy declaration that all “public utility facilities providing power generation” shall be considered Risk Category IV. This declaration appears without underlying study that makes any attempt to distinguish critical and highly consequential differences in failure risk profiles between individual renewable energy “power generation” structures that provide incrementally beneficial contributions to the electric grid, and conventional large-scale power plants.

MAJOR WIND PROJECT VIABILITY RISKS ASSOCIATED WITH S76-22

Current and future wind energy development depends on use of increasingly larger turbine rotors with longer blades (to capture a larger windswept area) and taller towers to not only accommodate the longer blades, but to best position the rotor to capture faster moving (higher energy) and less-turbulent (more predictable) wind. The overall economic objective is typically to maximize energy production value against wind turbine support structure costs, both of which tend to increase with height.

Unfortunately, existing transportation infrastructure currently restricts full optimization of conventional tubular steel wind towers, even under current RC-II code design loads. Tower engineers from every OEM are routinely challenged to design cost-effective tower sections that can be fabricated at the factory and transported by ship, rail and/or road to installation site, while respecting onerous transportation constraints such as roadway weight limits, road and rail height clearances from overpasses and tunnels that effectively limit external tower diameters, and road & rail curves that restrict tower section lengths. The segmenting of towers into additional tower sections to accommodate transport restrictions must be balanced against the high cost of additional splice flanges and bolts and additional erection costs. In some cases, an economical solution simply does not exist.

Unlike building structures and many industrial facilities, wind turbine towers are not readily scalable to accommodate increased design loads due to the transportation infrastructure restrictions. With S76-22 classifying wind turbine support structures as RC-IV, building code extreme wind design loads would increase a minimum of 22% compared to standard RC-II load levels across the continental U.S. This does not account for local tornado design loads, which will be required to be factored into the design load envelope for RC-IV and RC-III structures upon adoption of ASCE/SEI 7-22. The only plausible support structure solution that could accommodate the technical demand of such a large design load increase would not only entail a significant cost increase to the tower and foundation (roughly estimated at a combined +30%), but would necessitate a major reduction in tower height. The associated loss in energy value itself due to the reduced height is easily enough to render such projects economically unviable. This would have major implications for wind energy projects across all regions of the United States.

As for projects in regions of high seismic hazard where RC-II seismic design loads govern contemporary wind turbine support structure design, the 50% increase in seismic design loads attributable to RC-IV load levels preclude the technical development of any suitable tower from any OEM. This would have profound adverse implications for plans to replace or repower any of the thousands of existing obsolete wind turbines in dense wind energy sites in California like Altamont Pass, Riverside County/Palm Springs, and Tehachapi/Mojave.

Other public comments also in opposition to S76-22, and particularly the comment from the American Clean Power Association (ACP), provide detail on key points, including:

1) Electrical grid reliability and resiliency are inherently enhanced by policies that support the installation of multiple structurally independent and geographically distributed wind turbines,

2) Hypothetical failure of one or even multiple wind turbine support structures in a major disaster will not cause the adverse community impacts for which RC-IV categorization is intended to avoid,

3) Structural failures following actual extreme wind and seismic events due to perceived lack of structural integrity associated with RC-II level building code design loads for wind turbine tower and foundation support structures have been exceptionally rare, and

4) There is a lack of evidence that increasing building code design loads on individual wind turbine support structures commensurate with RC-IV levels would minimize power outages or avoid other adverse post-disaster community impacts.

The OEMs support these points.

The change in assignment of Risk Category for wind turbines as proposed by S76-22 will be cost and logistically prohibitive for wind energy in many cases without providing any measurable benefits in terms of resilience and recovery. The OEMs recommend that S76-22 be disapproved.

Bibliography: *ASCE/AWEA Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures* (ASCE/AWEA RP2011), American Wind Energy Association, December 2011.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3458

Public Comment 12:

Proponents: Jeroen van Dam, representing NREL (jeroen.van.dam@nrel.gov) requests Disapprove

Commenter's Reason: The National Renewable Energy Laboratory (NREL) opposes S-76-22 for the following reasons:

- The proposed change though simple in its implementation has broad impacts that are not well thought through. This includes significant impacts on the deployment of renewable energy.
- The proposed change is made with the argument of increasing grid resilience: it will not accomplish this and may in fact have the opposite effect.
- This proposal will increase costs and thus reduce the implementation of renewables on the grid. Renewables like Wind and PV solar are distributed in nature and deploying them on the grid will have a positive effect on grid reliability as it is less likely that an entire plant or all plants in an area will be impacted by a natural disaster. This was demonstrated in the case of hurricane Maria where the Punta Lima wind plant was impacted by the hurricane, yet the Santa Isabel wind plant located within 50 miles survived.
- Renewable Energy power plants are much smaller in capacity in comparison to traditional thermal plants and have built-in redundancy (PV plants have multiple strings with individual inverters, wind power plants consist of many individual wind turbines).
- Studies have shown that new generation needs to be built to keep up with increasing demands on the grid to maintain reliability. Renewables

like PV and Wind have both shown to be quickly deployable in comparison to coal, natural gas and nuclear plants. This proposal will reduce the implementation of wind energy as the relative cost increase due to the move from RC II to RC IV is more significant for wind energy as compared to other power generation.

- NREL is not aware of existing data that show that if wind plants would have been designed to Risk Category IV the grid would have stayed on line or recovered quicker in the wake of natural disasters. There are several articles showing no damage to wind turbines as a result of the hurricane Sandy: https://www.windpowermonthly.com/article/1158013/wind-farm-withstood-hurricane-sandy
- https://cleanenergy.org/blog/sandy-is-gone-wind-power-is-on/
- The proposal will negatively impact grid reliability as the proposal will drive developers to procuring less but more expensive wind turbines designed to RC IV instead of more, but less expensive, wind turbines designed to RC II. More wind turbines by definition provide more grid resilience and reliability through redundancy.
- A cursory cost analysis shows that the impact of the proposed change will increase the cost of Wind energy substantially more than the 2% listed by FEMA. This will significantly impact the economic viability of wind projects in earthquake, hurricane or tornado-prone regions. NREL plans to perform a more detailed independent cost analysis.
- The increase in costs will inadvertently jeopardize the renewable energy deployment goals of our federal government.
- Renewable energy is crucial in curbing climate change and its resulting increase in extreme weather events.

Jeroen van Dam

Principal Engineer

National Wind Technology

National Renewable Energy Laboratory

IEC TC 88 (Wind Energy Generation System) Chair

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This comment opposes the proposed change S76-22 which would increase the cost of wind energy beyond the stated "<2%" impact. By opposing S76-22 we can maintain the status quo and further help reduce the cost of energy for the public through deployment of renewable energy technology.

Public Comment# 3309

Public Comment 13:

Proponents: Scott Van Pelt, representing myself (scott.vanpelt@gamechangesolar.com) requests Disapprove

Commenter's Reason: The reason statement dictates that power generation facilities are "mostly assigned to RC III". This is not true for utility scale solar power plants. In excess of 90% of the utility scale solar power plants installed in the U.S. today are designed to RC I. S76-22 does not sufficiently address the dramatic effect of changing the required assignment of utility solar power plants from RC I to RC IV. The proposed change will cause climatic loads in many jurisdictions to exceed the mechanical ratings of most PV modules currently commercially available and therefore cause projects in these jurisdictions to be technically infeasible.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3294

Public Comment 14:

Proponents: Tom Vinson, representing American Clean Power Association (tvinson@cleanpower.org) requests Disapprove

Commenter's Reason: Summary:
S76-22 proposes to increase the risk category (RC) for power generation, including wind turbines, to RC IV. The American Clean Power Association (ACP) recommends S76-22 be disapproved. In summary, ACP's concerns are:S76-22 is based on two faulty premises:

(1) Power outages are caused by inadequate structural integrity of power generation facilities and, therefore, vastly increasing the minimum design load criteria will solve the problem.

However, per reports from grid reliability regulators and peer review studies: (1) outages are generally driven by transmission and distribution damage, not wind and solar generation facility damage and (2) wind and solar energy facilities have largely not suffered significant damage because of natural disasters.

Further, tens of thousands of wind turbines approved by authorities having jurisdiction (AHJs) under a RC II rating for wind turbines pursuant to ASCE/AWEA 2011 *Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures* have been structurally sound and available to generate power for communities during and after natural disasters, so the increase to RC IV as proposed in S76-22 is unnecessary and burdensome.

(2) Communities have power generation dedicated to serving their load and that power generation needs to be structurally stronger to support resilience recovery.

Except in communities that are electrically isolated from the broader power grid (such as villages in Alaska), the electrons from power generation of all types flows through the bulk electric system down to the distribution level based on physics. Generation is not dedicated to a particular community. Rather, grid operators instantaneously balance generation from various generation facilities in their region to match demand, including ramping up other generation in response to generator outages.

In that context, geographically dispersed power generation like wind and solar energy improve grid resilience, reliability, and functional recovery because (1) If an entire wind farm or solar facility ceases operation, which is rare, geographically diverse wind and solar farms elsewhere across the state or region are still putting electrons on the grid for delivery to homes and businesses and (2) even with a failure at an individual wind turbine(s) or solar panel section(s), the rest of the facility can continue to generate power.

Therefore, S76-22, which will make it more difficult to impossible to build additional facilities in at least some regions will inadvertently undermine reliability and resilience.

ACP also recommends disapproval of S76-22 because:

- By increasing the minimum building code design load criteria by up to 50% for wind turbines, S76-22 will be cost and logistically prohibitive to deploy wind energy in many cases without providing any measurable benefits in terms of resilience and recovery.
- By potentially making wind energy development impossible at least in certain regions and, at a minimum, more expensive everywhere, thus slowing deployment, S76-22 will inadvertently undermine reliability and safety.

Reason Statement:

While ACP understands the sponsor’s concerns about power outages and supports the intent to make communities more resilient, adding utility-scale power generation to Risk Category IV (RC IV) in Table 1604.5 as proposed in S76-22 will not have the effect intended by its authors. And, in fact, by potentially making renewable energy development impossible at least in certain regions and, at a minimum, more expensive everywhere, thus slowing deployment, S76-22 will inadvertently undermine grid reliability and recovery and, therefore, public health and safety. Further, the fact that S76-22 is drafted as applying to only “public utility facilities” does not materially change ACP’s concerns about the proposal given the uncertainty about how it will be interpreted in thousands of individual jurisdictions.

For more than a decade, wind turbine generators have been classified as Occupancy Category II, per the *Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures* (ASCE/AWEA RP2011). This document was co-designated by the American Society of Civil Engineers (ASCE) and the American Wind Energy Association (AWEA), and is used when classifying wind turbines. In 2012 the ICC changed from using Occupancy Category to Risk Category. Classifying a wind turbine as Risk Category II is now equivalent to the previous classification as Occupancy Category II.

AHJs have approved the construction of tens of thousands of wind turbines using this standard over the last eleven years. ACP is not aware of any increase in grid failure rates, including related to natural disasters and extreme weather, which would justify the significant change in the ratings for grid-connected wind turbines from RC II to RC IV. No specific evidence is presented by the proponents of S76-22 on wind turbines that explains why the existing RC II rating is inadequate to support resilience and functional recovery.

Moreover, S76-22 will make the transportation of wind towers potentially impossible in many parts of the country, given the added steel, weight, and size necessary to meet the new load requirements. Such significant changes to the design as proposed by S76-22 will mean the larger wind turbine tower sections will exceed many road, rail, and bridge height, weight and/or turn radii limits in the U.S.

The premise of S76-22 appears to be that power outages are caused by inadequate structural integrity of power generation facilities and, therefore, vastly increasing the minimum building code design load criteria by up to 50% will solve the problem. This premise is incorrect.

Various reports on generation outages over the last two decades by grid reliability regulators, the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC), have not identified the structural integrity of power generation as important factors.

- The U.S.-Canada Power Outage System Task Force Final Report on the August 14, 2003, Blackout in the Eastern United States and Canada identified four major causes all related to improper operation and maintenance of the transmission system by a utility in Ohio.
- A joint FERC-NERC staff report on blackouts in Arizona and Southern California on September 8, 2011, found the grid operator failed to maintain the transmission system within its system operation limits, which contributed to cascading outages.
- NERC's report on Hurricane Sandy, which made landfall on October 29, 2012, indicated "no damage was reported" to wind turbines in the impact area.
- NERC's report on Hurricane Harvey, which made landfall on August 25, 2017, found "only minimal damage" was reported at wind energy facilities and facilities other than one that were offline came back online on the next day or the day after on August 26 or 27.
- More recently, FERC-NERC issued a joint report on the February 2021 extreme cold and freeze event that led to multiple days of outages in Texas and more limited challenges in other states that identified two major causes: (1) power generation and natural gas pipelines were not adequately winterized which led to frozen equipment and systems and (2) inadequate supplies of natural gas meant there was insufficient gas for power generation as it was being used for home heating.

In response to all the above cases, FERC and NERC have adopted various federal rules and reliability standards to address the concerns that were identified.

Even the longest power outage in U.S. history in Puerto Rico after Hurricanes Irma and Maria in September 2017 was due primarily to 80% of the transmission and distribution network being inoperable and difficult to repair given mountainous topography, rather than power generation facilities being inoperable. As a peer reviewed article in the February 2019 *IEEE Power and Energy Technology Systems Journal* found, "damage to the conventional electric power generation infrastructure was relatively minor…". A 95 MW wind farm, Puerto Rico's largest, suffered "no damage" while at the other wind farm, located near Maria's landfall, the turbine blades were damaged, but only one turbine support structure failed. Of the five utility-scale solar facilities operating at the time, one was "practically undamaged," three experienced only "light to moderate" damage, and only one, in certain sections of the facility near Maria's landfall, suffered more significant damage.

S76-22 is essentially a proposed solution to a problem – inadequate structural integrity of power generation facilities – that largely does not exist and is not contributing to blackouts.

Geographically dispersed power generation like wind and solar energy improve grid resilience, reliability, and functional recovery. If an entire wind farm or solar facility ceases operation, which is rare, geographically diverse wind and solar farms elsewhere across the state or region are still putting electrons on the grid for delivery to homes and businesses.

Further, the failure at an individual wind turbine does not mean an entire wind farm stops operating. The remaining turbines can continue to generate power if the substation and transmission to the grid remains up and running. The same feature is true with respect to solar generation.

A premise of S76-22 also appears to be that communities have power generation dedicated to serving their load and that power generation needs to be structurally stronger. That also is largely incorrect.

Except in communities that are electrically isolated from the broader power grid (such as villages in Alaska), the electrons from power generation of all types flows through the grid based on physics, the generation is not dedicated to a particular community. Rather, grid operators instantaneously balance generation from various power facilities in their area to match demand. As a part of this balancing, the grid operators account for generation or transmission that is offline for maintenance, intermittent by design, or forced offline by a component or system failure or weather. In the U.S., the grid is largely operated on a regional basis, meaning grid operators ramp up and down generation over a geographically diverse area that is not impacted by a weather system the same way. Adding the geographic diversity of wind and solar, with the broad operating areas of the grid operators, supports resilience and recovery.

Further, grid operators require excess generation capacity that is well-beyond (15% or more) demand peaks (i.e. "reserve margins") to facilitate the ability to ramp up generation to meet demand and to address generator outages (both planned an unplanned).Finally, modern utility-scale wind and solar facilities support reliability, resilience, and recovery through providing essential reliability services to the power grid like frequency support, ramping, and voltage control as documented by the U.S. Department of Energy and other grid experts.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction Disapproving S76-22 as ACP recommends will retain the status quo for construction costs.

The proponents of S76-22 estimated an increase in construction costs of only 0-2%. However, this estimate significantly underestimates the cost for wind and solar energy compliance, and potential other facilities. FEMA acknowledges as much in their January 2021 joint report with NIST (FEMA P-2090/NIST SP-1254). Table 7-4 (page 70) in the report identifies the cost of Recommendation 4 to "mandate the Design of New and Upgrade of Existing Lifeline Infrastructure Systems to Meet Recovery-Based Objectives" is "high" with feasibility rated as "difficult" and the implementation timeline identified as "intermediate to long." Recommendation 4 is conceptually like S76-22. Yet, S76-22 seeks to impose this requirement now. The proponents do not acknowledge the "high" cost impact of S76-22 to the construction of wind and solar facilities.

The 0-2% cost increase estimated by proponents is based on the increase in design load for a building frame. A building frame is a smaller percentage of the overall cost of a building than the foundation and tower are for a wind turbine which are directly impacted by S76-22.

The change in assignment of Risk Category for wind turbines as proposed by S76-22 will hence be cost and logistically prohibitive for wind energy in many cases without providing any measurable benefits in terms of resilience and recovery.

Public Comment# 3292

Public Comment 15:

Proponents: John Williams, representing Committee on Healthcare (ahc@iccsafe.org) requests Disapprove

Commenter's Reason: The scope of the Healthcare committee is for healthcare facilities, such as ambulatory care facilities, clinics, nursing homes and hospitals. Therefore, this public comment is limited to the effect of the new language to the description of Risk Category IV and how it would effect the 1st and 2nd item in the list.

- Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities.
- Ambulatory care facilities having emergency surgery or emergency treatment facilities.

The added language in the description for Risk Category IV could be read that any of the current occupancies in this list could sustain loss of function as long as that damage did not represent a substantial hazard to the occupants. These are a list of essential facilities that must be operational after an event for the safety and recovery of the entire community. Hospitals that have emergency surgery or emergency treatment facilities need to be operational after an emergency. There could be a lot of damage to the building that would not be a substantial hazard to occupants, but would stop the emergency room from functioning.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3058

S77-22

Proposed Change as Submitted

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

2021 International Building Code

Revise as follows:

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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 <u>and buildings where loss of function represents a substantial hazard to occupants</u>, including but not limited to:

RISK CATEGORY	NATURE OF OCCUPANCY
	Group I-1 occupancies in which at least half of the Group I-1 care recipients qualify as Group I-1, Condition 2 Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: This proposal improves consistency in the assignment of risk categories. It applies current thinking from IBC Chapters 3 and 4 to the risk category assignments in Table 1604.5. The logic of the proposal is as follows:

1. **Risk Category IV is the IBC's main tool to provide functional facilities** soon after a natural hazard event (earthquake, flood, snow, or wind). In terms of post-event functionality, there is a wide gap between RC II-III facilities (which have identical requirements for nonstructural systems) and RC IV facilities. The difference in expected recovery time can be on the order of weeks or months.
2. The performance gap between RC II-III and RC IV is most acute for occupancies that depend on functional nonstructural systems and special design provisions to serve vulnerable users.
3. Because these facilities are rare and specially designed, their services and occupants cannot be quickly relocated to other buildings.
4. Therefore, facilities with special design features and vulnerable users should be strong candidates for Risk Category IV.

Following this logic, this proposal expands the scope of RC IV from just "essential facilities" to include "buildings where loss of function represents a substantial hazard." **This "substantial**

hazard" can even be life threatening where, for example, a 24-hour medical facility, residential care facility, public water or power utility, detention center with impeded egress, or critical supply chain facility is out of service for weeks. The code defines *essential facilities* as those that need to "remain operational" through and after an "extreme" earthquake, flood, wind, or snow event. The additional facilities described by the logic above and considered in this proposal might not require continuous operation, but **prolonged downtime – which can be expected from RC II design criteria – can give rise to a similar risk for vulnerable users**, if not on Day 1 after the event, then possibly by Day 3, 10, or 30.

This proposal addresses custodial care facilities that provide housing for vulnerable residents. Group I-1 buildings, currently assigned to RC II, provide **24-hour supervised housing** for residents receiving ***custodial care***, a defined term meaning assistance with day-to-day tasks, including bathing, cooking, and taking medication. This proposal reassigns certain Group I-1, Condition 2 facilities to RC IV.

Condition 2 occupancies include assisted living facilities (this is the term used in Sections 308.2 and 420.7) and similar care facilities. Residents in these facilities require assistance with daily tasks as well as **assistance with emergency egress** in or after natural hazard events. These facilities are already required to meet special design requirements in IBC Section 420, and specifically Section 420.7, regarding sprinklers, alarms, refuge areas, and cooking facilities. These requirements are not met by normal market housing. Further, the staffs that provide supervision and assist residents with their daily tasks have facility-specific training and resources. Therefore, residents of these facilities cannot be simply relocated to market housing.

Because Group I-1 facilities can sometimes combine Condition 1 and Condition 2, the proposal assigns to RC IV only those that are majority Condition 2. Since Group I-1 includes only facilities with at least 17 residents, only facilities with at least 9 residents qualified as Condition 2 are covered by this proposal.

Despite this reassignment, this proposal is measured in its scope. **It does NOT affect:**

- Custodial care facilities for 16 or fewer residents. Per Section 308.2, Group I-1 applies only to larger facilities.
- Group I-1, Condition 1 facilities, whose residents are more capable of self-preservation than those in Condition 2. For example, alcohol and drug centers, halfway houses, and other care facilities are included in Group I-1 but are likely Condition 1.
- Group I-1 facilities that are majority Condition 1.
- Other small residential facilities assigned to Group R, even if subject to Section 420.
- Any residential or care facility eligible for design under the IRC.
- Daycare facilities (child or adult), typically in Group I-4.

This proposal is consistent with current IBC principles. This proposal extends the current scope of Risk Category IV, but it does so consistent with the purpose, philosophy, and normative goals the IBC already represents.

Even if you think of the IBC as strictly a "life safety" code, safety is more than mere survival, and safety can be at risk even after the rain, snow, or ground shaking has stopped. If building damage affects the safety of vulnerable users in the following days or weeks, it is consistent with even a safety-based code to manage those risks through design.

But the IBC's purpose is broader than just "life safety." Section 101.3 states that the purpose of the IBC is to provide a "reasonable level of safety, **health and general welfare**." So a focus on the health and welfare of vulnerable building users, even where their building provides immediate safety, is both "reasonable" and completely consistent with the purpose of the code.

With its definition of *essential facilities* and its use of Risk Category IV to ensure they "remain operational," the IBC is already more than a safety code. It is, in fact, already a basic "functional recovery" code; the only question is which building uses, and users, we decide should qualify for a designed recovery. Where RC II or RC III is not reliable enough, it is consistent with the purpose and scope of the IBC to assign more building uses to RC IV.

Not all of the IBC's tools are perfectly nuanced. Some involve bright lines and broad categories, and it is sometimes necessary to err on the conservative side. So even if a certain use is not quite as "essential" as a fire station, RC IV might still be a more appropriate choice than RC II or RC III, and in these cases, it is consistent with the code to assign buildings to the higher category. In time, design criteria should evolve to address more specific recovery objectives (FEMA, 2020; FEMA-NIST, 2021). But those nuanced provisions are *at least* a decade away. For now, however, RC IV is the most appropriate tool we have, and we ought to use it. Adapting existing practices to new objectives is entirely consistent with the history of code development.

IBC Chapters 3 and 4 define and provide special requirements to manage fire and egress risks for particular groups of users. Table 1604.5 is meant to do the same for rare natural hazard events. But while Chapters 3 and 4 consider dozens of specific building uses and conditions, Table 1604.5 has only four categories. Changing the scope of Risk Category IV to account for specific building uses that are not adequately served by RC II or RC III criteria is consistent with the detailed, use-specific approach of Chapters 3 and 4.

Table 1604.5 represents public policy about what we desire from our buildings. As such, it has changed over time, along with public expectations. As we consider new or increasing risks related to more frequent natural hazard events, urbanization, the pandemic, or aging populations, it is both appropriate and consistent with past practice for Table 1604.5 to evolve as well.

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FEMA (2020b). *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures, Volume II: Part 3 Resource Papers*, 2020 Edition, FEMA P-2082-2, prepared by the Building Seismic Safety Council of the National Institute of Buildings Sciences for Federal Emergency Management Agency, September.

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

This proposal will increase the cost of construction for the buildings newly assigned to RC IV. The largest increases will likely be in high seismic areas where assignment to RC IV makes the largest changes to structural and nonstructural design criteria. This does not mean, however, that every RC IV facility will have the same unit cost as a new state-of-the-art hospital. On the contrary, case studies of voluntary RC IV-like seismic design have found a **construction cost premium ranging typically from 0% to 2%** relative to normal RC II designs. (See proposal references by Almufti, Bade, Berkowitz, Mar, and SEFT.) This estimate stands to reason: Wind, snow, and earthquake loads can already vary significantly within a jurisdiction, but the building designs and unit costs don't change wildly from one side of the county to the other. For example, the seismic design force in Berkeley is about 1.5 times that in downtown San Francisco; so with respect to the structure, any nursing home or grocery store you can build as RC II in Berkeley you can also build as RC IV in San

Francisco with no change to the design. The same is likely true for snow design, for example, in Vail v. Boulder and for wind design in Galveston v. the west side of Houston. On the nonstructural side, a facility's nonstructural systems might need more bracing or support when assigned to RC IV, but the number and size of the components themselves don't suddenly look like a hospital just because the risk category has changed.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the broad definition of I-1 condition 2 could be extended beyond the intent and could have the unintended result of less I-2 condition 2 facilities. The committee noted that the 'half' could be hard to enforce as the type of facilities addressed tend to regularly change number of vulnerable residents. (Vote: 12-2)

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1604.5

Proponents: David Bonowitz, representing Self (dbonowitz@att.net) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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.

RISK CATEGORY	NATURE OF OCCUPANCY
	Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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 and buildings where loss of function represents a substantial hazard to occupants, including but not limited to: Group I-1 ~~occupancies in which at least half of the Group I-1 care recipients qualify as Group I-1~~, Condition 2 <u>assisted living facilities.</u> Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that 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.

Commenter's Reason: This public comment responds to concerns raised at the committee action hearings.

- Wayne Jewell correctly noted that the proposal as submitted, by trying to parse combinations of Group I-1 Condition 1 and Condition 2, creates an unnecessary enforcement headache and is dismissive of facilities with fewer assisted living units. This comment fixes that problem by simply focusing on Group I-1 Condition 2 in any form. This change makes proposal S77 consistent in implementation and enforcement with IBC Section 420 (especially 420.6 through 420.9) which already rely on the building official to identify Condition 1 v. Condition 2 without specific provisions for all the possible combinations. If the building official can enforce current Section 420, he or she can enforce S77 as modified by this public comment.
- Jonathan Flannery, on behalf of the ICC Healthcare Committee, correctly noted that Condition 2 still encompasses a wide range of uses. This comment fixes that problem by narrowing the scope to "assisted living facilities," a specific facility type and a term already used in IBC Sections 308.2 and 420.7.

As with the original proposal (see the bullet list there) and with the current code, S77 as modified by this comment still would not affect any facility with up to 16 care recipients.
Importantly, **nobody at the hearings argued that assisted living facilities and their occupants should *not* have the protections provided by Risk Category IV**. On the contrary, the speakers in opposition both noted how important these facilities are and the unacceptable costs imposed on the community when they are forced to shut their doors for any reason.
There was one comment at the hearings about the possibility that increased construction costs resulting from this change could discourage the development of I-1 facilities, but a) that is acknowledged in the cost impact statement, and the question, as always, is whether the benefits exceed the costs (I believe they do), b) the same argument can be made for any use assigned to RC IV, and if dispositive, it would mean that Table 1604.5 can never be changed, and c) the fast-growing market for senior and memory care facilities has already found its own efficiencies and has demonstrated that development in this sector is not going to be easily inhibited by small cost increases. On the contrary, it's a growth industry.
And that last point raises a topic rarely heard at ICC hearings: Private equity. As shown in the MEDPAC and Seniors Housing Business references (see bibliography), private equity is increasingly buying and building assisted living (I-1) and nursing home (I-2) facilities. These facilities have long been for-profit businesses, but Gupta et al. show that the nature of private equity (PE) is different and is likely to lead to an even greater shift of owner interest from patient care to investor profit, with increased mortality already observed. They write that nursing homes and assisted living facilities are especially vulnerable to these new market conditions:
"The past two decades have seen a rapid increase in Private Equity (PE) investment in healthcare, a sector in which intensive government subsidy and market frictions could lead high-powered **for-profit incentives to be misaligned with the social goal of affordable, quality care**. ... PE's success in other sectors may not be relevant to healthcare, which suffers from unique market frictions. For example, patients cannot accurately assess provider quality, they typically do not pay for services directly, and a web of government agencies act as both payers and regulators (Cutler, 2011; Skinner, 2011). **These features weaken the natural ability of a market to align firm incentives with consumer welfare and could mean that high-powered incentives to maximize profits have detrimental implications for consumer welfare** (Hansmann, 1980; Hart et al., 1997; Chandra et al., 2016)." [Emphasis added.]
If the owners of these vital facilities are now more willing than ever to cut costs, cut care, and walk away from losses -- at the direct expense of the vulnerable occupants and at the indirect expense of the community -- the least the building code can do is ensure that a major earthquake, hurricane, or winter storm does not add to the problem by giving them yet another excuse. The building code provides essentially one tool to express the importance of natural hazard resistance and recovery through design, and that tool is assignment to Risk Category IV.

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Seniors Housing Business, 2021. "IRA Capital Buys 160-Unit Portfolio in Northern California for $106.5M." January 21. Available at https://seniorshousingbusiness.com/ira-capital-buys-160-unit-portfolio-in-northern-california-for-106-5m/

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Same as the original proposal.

S78-22

<u>***Proposed Change as Submitted***</u>

Proponents: David Bonowitz, representing Self (dbonowitz@att.net)

2021 International Building Code

Revise as follows:

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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 <u>and buildings where loss of function represents a substantial hazard to occupants or users</u>, including but not limited to: Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities.

RISK CATEGORY	NATURE OF OCCUPANCY
	Ambulatory care facilities having emergency surgery or emergency treatment facilities. Group F-1 food processing establishments or commercial kitchens, not primarily associated with dining facilities, with *gross floor area* exceeding 30,000 square feet. Group M retail or wholesale stores with *gross floor area* exceeding 30,000 square feet in which at least half of the usable floor area is used for the sale of food or beverages. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason:
This proposal improves consistency in the assignment of risk categories. It applies current thinking from IBC Chapters 3 and 4 to the risk category assignments in Table 1604.5. The logic of the proposal is as follows:

1. **Risk Category IV is the IBC's main tool to provide functional facilities** soon after a natural hazard event (earthquake, flood, snow, or wind). In terms of post-event functionality, there is a wide gap between RC II-III facilities (which have identical requirements for nonstructural systems) and RC IV facilities. The difference in expected recovery time can be on the order of weeks or months.
2. The performance gap between RC II-III and RC IV is most acute for occupancies that depend on functional nonstructural systems and special design provisions to serve vulnerable users.
3. Because these facilities are rare and specially designed, their services and occupants cannot be quickly relocated to other buildings.
4. Therefore, facilities with special design features and vulnerable users should be strong candidates for Risk Category IV.

Following this logic, this proposal expands the scope of RC IV from just “essential facilities” to include “buildings where loss of function represents a substantial hazard.” **This “substantial hazard” can even be life threatening** where, for example, a 24-hour medical facility, residential care facility, public water or power utility, detention center with impeded egress, or critical supply chain facility is out of service for weeks. The code defines *essential facilities* as those that need to “remain operational” through and after an “extreme” earthquake, flood, wind, or snow event. The additional facilities described by the logic above and considered in this proposal might not require continuous operation, but **prolonged downtime – which can be expected from RC II design criteria – can give rise to a similar risk for vulnerable users**, if not on Day 1 after the event, then possibly by Day 3, 10, or 30.

This proposal addresses large facilities that are essential to a stable food supply chain. “Food and Agriculture” has been designated a “critical infrastructure sector” by the federal government since 2003 and as such, is addressed in the National Infrastructure Protection Plan (NIPP). The mission of the sector is “to protect against a disruption anywhere in the food system that would pose a serious threat to public health, safety, welfare, or to the national economy,” and to achieve that mission, the NIPP relies explicitly on “the support and action of the private sector.” (FDA et al., 2015) No doubt that reliance includes the government’s general adoption of ICC’s model codes. Indeed, while the NIPP lays out an extensive sector taxonomy including categories for “Processing, Packaging, and Production” and “Agricultural and Food Product Distribution,” it says almost nothing about the design of these critical facilities as buildings. For that, **the NIPP is relying on the IBC**, which labels these facilities as “food processing establishments,” “commercial kitchens,” and “retail or wholesale stores” – and currently assigns them all to Risk Category II, just like any other factory or shop.

More recently, as cities and states took actions against the COVID pandemic, nearly all immediately recognized grocery stores, food banks, and other establishments on the food supply chain as **“essential businesses”** (For example, SFDPH, 2020), and the federal government issued an advisory identifying grocery and food manufacturing employees as **“essential critical infrastructure workers”** (CISA, 2020). This recognition not only reflected an obvious need – one that arises after every natural hazard event as ell – but was also consistent with the NIPP’s emphasis on public health and the economy, not just building-specific safety.

Food processing facilities, commercial kitchens, and large grocery stores have mechanical, electrical, and plumbing systems unlike those in other RC II commercial buildings. Only Risk Category IV design provisions address the post-event functionality of these nonstructural systems. For these reasons, this proposal considers certain Group F-1 and Group M uses currently assigned to RC II. The proposal reassigns the largest of these, with gross floor areas exceeding 30,000 square feet, to RC IV. The 30,000 square foot criterion is meant to **exempt minor processing facilities and small stores that are less likely to disrupt the local food supply chain if damaged**. In the larger facilities, the per-building costs of a Risk Category IV design (such as the seismic certification of designated equipment, discussed below) are also less significant. The 30,000 square foot criterion is based on an in-progress inventory of existing grocery stores in San Francisco, where buildings of this size are all standalone supermarkets serving large customer bases, as opposed to specialty stores within larger buildings. The proposed cutoff size is somewhat arbitrary, but no more so than that other arbitrary measures of size or occupant load used by the current code to assign occupancy or risk category. The exercise of assigning occupancies and risk categories has always involved drawing lines based on judgment, so this is no departure from past code development practices.

The two uses proposed for RC IV are:

- Large Group F-1 food processing establishments or commercial kitchens. Consistent with Section 306.2, this proposal includes only those facilities not associated with specific dining facilities. Also, Section 306.2 applies to these uses in buildings larger than just 2500 square feet, so the proposed 30,000 square foot criterion is far more selective.

- Large Group M supermarkets. As described above, the 30,000 square foot criterion is meant to capture only the type of store that serves a large area and could represent a large portion of the local food distribution system. Because many of these larger facilities sell a variety of items, the proposal includes only those where at least half the floor space is dedicated to food supply.

Despite this reassignment, this proposal is measured in its scope. **It does NOT affect:**

- Processing facilities or markets smaller than 30,000 square feet.
- Multi-purpose stores selling non-food items where less than half the area is for food.
- Facilities primarily associated with specific restaurants or dining establishments.
- Food warehouses, trucking facilities, or other distribution facilities along the food supply chain, even if associated with the RC IV processing facility or supermarket.

This proposal is consistent with current IBC principles. This proposal extends the current scope of Risk Category IV, but it does so consistent with the purpose, philosophy, and normative goals the IBC already represents.

Even if you think of the IBC as strictly a “life safety” code, safety is more than mere survival, and safety can be at risk even after the rain, snow, or ground shaking has stopped. If building damage affects the safety of vulnerable users in the following days or weeks, it is consistent with even a safety-based code to manage those risks through design.

But the IBC’s purpose is broader than just “life safety.” Section 101.3 states that the purpose of the IBC is to provide a “reasonable level of safety, **health and general welfare**.” So a focus on the health and welfare of vulnerable building users, even where their building provides immediate safety, is both “reasonable” and completely consistent with the purpose of the code.

With its definition of *essential facilities* and its use of Risk Category IV to ensure they “remain operational,” the IBC is already more than a safety code. It is, in fact, already a basic “functional recovery” code; the only question is which building uses, and users, we decide should qualify for a designed recovery. Where RC II or RC III is not reliable enough, it is consistent with the purpose and scope of the IBC to assign more building uses to RC IV.

Not all of the IBC’s tools are perfectly nuanced. Some involve bright lines and broad categories, and it is sometimes necessary to err on the conservative side. So even if a certain use is not quite as “essential” as a fire station, RC IV might still be a more appropriate choice than RC II or RC III, and in these cases, it is consistent with the code to assign buildings to the higher category. In time, design criteria should evolve to address more specific recovery objectives (FEMA, 2020; FEMA-NIST, 2021). But those nuanced provisions are *at least* a decade away. For now, however, RC IV is the most appropriate tool we have, and we ought to use it. Adapting existing practices to new objectives is entirely consistent with the history of code development.

IBC Chapters 3 and 4 define and provide special requirements to manage fire and egress risks for particular groups of users. Table 1604.5 is meant to do the same for rare natural hazard events. But while Chapters 3 and 4 consider dozens of specific building uses and conditions, Table 1604.5 has only four categories. Changing the scope of Risk Category IV to account for specific building uses that are not adequately served by RC II or RC III criteria is consistent with the detailed, use-specific approach of Chapters 3 and 4.

Table 1604.5 represents public policy about what we desire from our buildings. As such, it has changed over time, along with public expectations. As we consider new or increasing risks related to more frequent natural hazard events, urbanization, the pandemic, or aging populations, it is both appropriate and consistent with past practice for Table 1604.5 to evolve as well.

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SEFT Consulting Group (2015). “Beaverton School District Resilience Planning for High School at South Cooper Mountain and Middle School at Timberland,” SEFT Consulting Group, July 10.
SFDPH, 2020. “Order of the Health Officer No. C19-07b.” City and County of San Francisco, Department of Public Health, March 31, et seq.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction for the buildings newly assigned to RC IV. The largest increases will likely be in high seismic areas where assignment to RC IV makes the largest changes to structural and nonstructural design criteria. This does not mean, however, that every RC IV facility will have the same unit cost as a new state-of-the-art hospital. On the contrary, case studies of voluntary RC IV-like seismic design have found a **construction cost premium ranging typically from 0% to 2%** relative to normal RC II designs. (See proposal references by Almufti, Bade, Berkowitz, Mar, and SEFT.) This estimate stands to reason: Wind, snow, and earthquake loads can already vary significantly within a jurisdiction, but the building designs and unit costs don’t change wildly from one side of the county to the other. For example, the seismic design force in Berkeley is about 1.5 times that in downtown San Francisco; so with respect to the structure, any nursing home or grocery store you can build as RC II in Berkeley you can also build as RC IV in San Francisco with no change to the design. The same is likely true for snow design, for example, in Vail v. Boulder and for wind design in Galveston v. the west side of Houston. On the nonstructural side, a facility’s nonstructural systems might need more bracing or support when assigned to RC IV, but the number and size of the components themselves don’t suddenly look like a hospital just because the risk category has changed.

Public Hearing Results

Committee Action: **Disapproved**
Committee Reason: Disapproved as the the concept should be a local jurisdiction decision for the Risk Category IV for Group F-1 food processing establishments and Group M retail/wholesale stores. (Vote: 13-1)

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1604.5

Proponents: David Bonowitz, representing Self (dbonowitz@att.net) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency 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 and buildings where loss of function represents a substantial hazard to occupants or users, including but not limited to:

RISK CATEGORY	NATURE OF OCCUPANCY
	Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Group F-1 food processing establishments or commercial kitchens, not primarily associated with dining facilities, with *gross floor area* exceeding 30,000 square feet. ~~Group M retail or wholesale stores with *gross floor area* exceeding 30,000 square feet in which at least half of the usable floor area is used for the sale of food or beverages.~~ Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated 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 1004.5 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 that 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.

Commenter's Reason: Two words you don't often hear in an ICC code hearing: Baby formula.
In February 2022, a single food processing facility in Michigan shut down because of a bacterial contamination, leading to a nationwide shortage of baby formula that required a national response, including a rare use of the Defense Production Act. The plant remained out of production for 4 months -- and then shut down again two weeks after reopening, this time due to flood damage. (NPR, 2022).
So with respect to the Structural Committee (see its reason for disapproval above) and those who testified in opposition to S78 at the committee action hearings, the stability of a hyper-optimized, just-in-time food supply chain can NOT be left to each local community. On the contrary, the potential effects of breakage to critical supply chains (see the original S78 reason statement) shows why certain facilities traditionally assigned to Risk Category II -- like large food processing plants with multi-jurisdictional reach -- actually need to be assigned by the national model code to RC IV. Lots of things can hamper a food supply chain -- product recalls, labor actions, war, pandemic -- but the building code gives us a tool to help ensure that damage from an earthquake, hurricane, or winter storm is not on that list. The least we can do as design professionals and building officials is to assign facilities proven to be critical to RC IV.

In fact, at the hearings, several speakers and committee members recognized that the portion of proposal S78 regarding Group F-1 food processing facilities is actually a good idea and appears workable.
By contrast, the portion of S78 regarding Group M grocery stores, admittedly, does pose implementation and enforcement challenges, as I acknowledged at the hearings. Therefore, to fix that problem and preserve the most critical part of the proposal, this public comment removes the Group M item and retains the Group F-1 item.

Bibliography: NPR, 2022. "Abbott's baby formula plant closes again after severe storms and flooding." June 16. https://www.npr.org/2022/06/16/1105488061/baby-formula-plant-abbott-closed-flooding

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Similar to the original proposal, but with a smaller effect because the public comment retains only one of the two building groups originally proposed.

S79-22

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Building Code

1604.5Risk 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.

> **Exception:** The assignment of buildings and structures to Tsunami *Risk Categories* III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

Revise as follows:

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. *<u>Ground-mounted photovoltaic (PV) panel systems</u>*<u>.</u>
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000.[a] Power-generating stations <u>with individual power units not smaller than 100 MW</u>, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV.

RISK CATEGORY	NATURE OF OCCUPANCY
	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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. Power-generating ~~stations~~ and other public utility facilities <u>required for compliance</u> 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 1004.5 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 that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Reason: IBC Section 1604.5 and IBC Table 1604.5 are presently silent for assignment of risk category for all types of photovoltaic (PV) installations. This is a serious gap that still exists in the IBC, even as many other PV provisions in the I-codes have matured over several cycles.

The problem this proposal seeks to resolve is confusion and gross inconsistencies regarding the assignment of risk categories for PV projects. With zero guidance in the IBC, AHJs and other code-enforcing authorities are left to make up their own rules and their own policies, based on their own personal opinions and interpretations. While there is broad agreement on several of these topics, there are outlier cases where the most stringent AHJs create interpretations that increase the cost of construction arbitrarily. With a code that is silent, industry stakeholders and permit applicants have no recourse other than to attempt a negotiation at the building department counter with each AHJ or sometimes with each project.

As there are several primary types of structures used to support PV panels, it is a serious gap in the IBC to be entirely silent on assignment of risk category for these primary applications. Justification is provided here for each of the six categories in this proposal. Note these line items are based on the following definitions. The first definition has appeared in several cycles of the IBC.

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

During Group A proceedings in 2021, Proposal G193-21 was approved As Submitted, creating two new definitions that are foundational to the assignment of risk category.

PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND-MOUNTED. An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.

PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED. An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.

Justification by proposal line item is provided as follows:

1. *Ground-mounted PV panel systems*serving Group R-3 buildings shall be assigned as Risk Category I (one).

We hope all stakeholders can agree that a ground-mounted PV panel system installed in the back yard behind someone's home does not need to be anything other than Risk Category I (one), as it represents "a low hazard to human life in the event of failure."

2. *Ground-mounted PV panel systems*shall be assigned as Risk Category I (one).

Fundamentally, ground-mounted PV panel systems meet the description of Risk Category I, as they "represent a low hazard to human life in the event of failure."

Unfortunately, the Solar Energy Industries Association (SEIA) is aware of a broad range of interpretation by local authorities regarding proper assignment of Risk Category for ground-mounted PV panel systems. This is especially true -- and especially impactful -- for large-scale (often referred to as "utility scale") ground-mounted PV facilities. Given the same set of construction drawings, different building department staff can reach different conclusions, based on different rationale. Different building departments have reviewed projects that are fundamentally the same design, and determined it was Risk Category I, or Risk Category II, or Risk Category III. A few reviewers have even claimed the same design should be assigned as Risk Category IV. Owing to this broad range of opinions and beliefs, the solar industry cannot design a large-scale solar facility without first asking the building code official to make this determination, and the design features and associated cost of construction of a solar facility are therefore dependent on individual opinions and beliefs of reviewers. This is far too subjective.

This inconsistency in the assignment of risk category for ground-mounted PV systems is sometimes based on the Risk Category III description that reads: "Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV." Unfortunately, there is no definition in the IBC for "power generating stations," so it has no distinct meaning and no consistent interpretation. Is a ground-mounted PV system in the back yard of a residential property a "power generating station"?

With no definition found in the IBC, we can search ASCE 7-16 and find Section 15.5.4.1, which states: "Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbo machinery." While ASCE 7-16 Table 1.5-1 does not use the term "power generating station" or "electrical power generating station," the description of Risk Category III includes "Buildings and other structures … with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure." It is clear that the original intent of "power-generating stations" as Risk Category III structures was based on large power-generating units such as turbines and was never intended to apply to individual PV panel systems that had not yet scaled at the time this language was created.

ASCE 7-16 Commentary C1.5 states in part: "Risk Category III ... has also included structures associated with utilities required to protect the health and safety of a community, including power generating stations and water treatment and sewage treatment plants. ... Failures of power plants that supply electricity on the national grid can cause substantial economic losses and disruption to civilian life when their failures can trigger other plants to go offline in succession. The result can be massive and potentially extended power outage, shortage, or both that lead to huge economic losses because of idled industries and a serious disruption of civilian life because of inoperable subways, road traffic signals, and so forth."

IMPORTANT: It is extremely important to note there is a fundamental difference between the physical behavior of conventional turbine power plants and PV facilities. For example, if one reactor shuts down at a nuclear power plant, over 1 gigaWatt of power production can be lost at once. The physical behavior of ground-mounted PV facilities is not the same as turbine-based power generating stations. Where failures in PV facilities have been observed – except in the most extreme cases during hurricanes Irma and Maria -- they are typically localized failures that do not shut down the entire plant.

This behavior is described in future ASCE 7-22 Commentary Section C32.5.2.1, which states in part: "Large-scale photovoltaic facilities can cover hundreds of acres of land, yet they are composed of hundreds or thousands of small, structurally independent 'tables' of PV panels, each with their own independent foundation system. The PV panels on these independent nonbuilding structures are linked with electrical conductors to central inverters that convert DC power to AC power. Large-scale PV facilities can have dozens to hundreds of independent central inverters. If an electrical fault is detected, only the inverter associated with that fault is shut down, and the remainder of the facility remains operational. The entire PV facility will shut down only if the electrical substation is shut down, or if the system otherwise detects a loss of the AC signal from the grid. Substations and grids are outside the scope of ASCE 7.

While there is little data of tornado strikes on large-scale PV facilities, in two known cases the damage from a tornado strike was isolated to localized damage. These facilities typically remain operational with localized damage. For ground-mounted photovoltaic installations, the effective plan area A_e should be the size of the largest structurally independent nonbuilding structure supporting PV panels."

Further, PV panel systems are by their nature an intermittent power source. They convert sunlight to electricity, producing power during daylight hours only. Photovoltaic power systems do not cause substantial economic losses and disruption to civilian life when they stop producing power during night-time hours. We acknowledge that the addition of Energy Storage Systems (ESS) is changing this part of the conversation. However, the addition of ESS does not change the fact that where structural failures have occurred in ground-mounted PV panel systems (except as noted), those failures have been localized and did not trigger a complete shut-down of a power plant. Where electrical faults are detected, individual inverters can shut down portions of a power plant, without any disruption to civilian life. Therefore, they do not meet the IBC or ASCE 7 criteria for Risk Category III.

There are other considerations that have been brought up for discussion.

Some AHJs have expressed an opinion that ground-mounted PV systems can be assigned as Risk Category I only if they are enclosed by a fence. While most large-scale PV facilities are in fact enclosed within a fence, they are simply not facilities open to the public. They can be accessed only by authorized personnel, who are keenly aware of behavioral conditions during weather events. It is not rational to assign an increased risk category and associated increase in cost of construction to protect possible trespassers. In a different case, with small projects located at school sites, there could be provisions for keeping students and other unauthorized people away from PV systems, but this is independent of the assignment of risk category.

In another deviation from the norm, at least one AHJ requires an increase of risk category based on proximity to highways, schools, or residential developments, with an apparent rationale that a dislodged PV panel could become airborne and cause injury at some distance away from the PV facility after being carried by high winds. In this case, the concern of the AHJ is one failure mode only – panel dislodgement. It would be far more rational to refer to Failure Modes and Effects (FMEA) analysis to focus on the root cause of that one failure mode, and to then solve the problem directly. It is not rational to use a very indirect approach of arbitrarily increasing the risk category of the entire facility because of concern about one failure mode, thereby increasing the structural loads and increasing the cost of the PV facility – perhaps without even solving the problem.

It is true that dislodgement of PV panels has been observed in some cases. It is also true that dislodgement of PV panels has led to progressive failure, as observed in at least one catastrophic failure during a hurricane event. Focused work is underway today to address that identified risk. Attachment of PV panels to the superstructure is being considered by the recently formed ASCE Solar PV Structures Committee. Recommendations are expected to be published in the future Manual of Practice. This is a problem to be solved that is independent of assignment of risk category.

There are other factors that have been identified in forensic studies, which are usually conducted under Non-Disclosure Agreements (NDAs). Work is underway to gather data that can be anonymized and aggregated, in an effort of continual improvement. Some of this work is being funded under a grant by the U.S. Department of Energy. Members of the structural engineering community who are deeply involved in solar projects are engaged in these efforts.

There are other factors that can contribute to increased reliability and resilience of PV facilities. For example, better consideration of gust effect factor and topographic factors; and a growing knowledge base from boundary layer wind tunnel studies; as well as design, specification, installation, and maintenance of components. It is both more rational and more economical to focus directly on resolving specific issues. It is not rational to believe we can increase risk category and wind loads until problems are nonexistent.

For any situation where project owners or financiers desire enhanced performance beyond code-minimum provisions for safety, a performance factor could be developed to voluntarily increase structural loads, but this should be independent of code-prescribed assignment of risk categories or methods for determining minimum structural loads.

3. *Elevated PV support structures* other than those described in Items 4 and 6 shall be assigned as Risk Category II (two).

The newly defined term for elevated PV support structures will make it easier to clarity the assignment of risk category. Elevated PV support structures are often constructed on the ground surface over parking spaces. In this application, the elevated PV support structures are not using any space that is not already used as a parking lot, and they provide the added benefit of providing shade for vehicles. Elevated PV support structures can also be constructed on the ground surface to provide shade for other uses, such as picnic areas. In all of these cases other than described in Items 4 and 6, elevated PV support structures meet the criteria and intent for Risk Category II.

There are also some emerging agricultural uses, sometimes referred to as “agri-voltaics.” As one example, elevated PV support structures have been built over cranberry bogs. Although there could be an exception for agricultural use, for simplicity this proposal is not seeking to treat agricultural uses differently than the more-common installations assigned as Risk Category II.

4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category*that is the same as the *risk category*of the building on which they are mounted.

This concept is widely accepted by industry and AHJs and should not be controversial. Where PV panel systems are mounted on building roofs, whether attached or unattached, they shall be assigned as the same risk category as the building on which they are mounted. Elevated PV support structures have been installed on top of buildings along with vegetative roof features, and on top of parking garages over parking spaces. In any of these cases, PV structures must be designed to at least the same risk category as the building on which they are installed.

5. *PV panel systems* and *elevated PV support structures paired* with *energy storage systems (ESS)*and serving as a dedicated, stand-alone source of backup power for Risk Category IV (four) buildings shall be assigned as Risk Category IV (four).

The intermittent nature of power generation makes PV panel systems and elevated PV support structures an extremely unlikely choice as an on-site, sole source of required emergency backup power for a Risk Category IV structure. We believe most essential services facilities are still using fuel-powered (usually diesel) generators and a stock of fuel for backup power. However, with increasing adoption of Energy Storage Systems (ESS), it is conceivable that PV paired with ESS could be a sole source of required backup power.

Where PV plus ESS is the only direct source of backup power for an essential services facility – with a transfer switch or other equipment enabling it to operate independently from the grid during a time of grid power outage – it shall be assigned as Risk Category IV. If PV plus ESS is not designed to operate in the event of grid power outage, then it need not be Risk Category IV. This assignment of risk category can also apply when power switching enables the use of either the PV + ESS or a generator interchangeably.

6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as Risk Category IV (four).

There could be cases where elevated PV support structures are installed on the same site as a Risk Category IV building, over surface parking spaces that are designated for emergency services vehicles. Whether or not those elevated PV support structures are serving as part of a backup power source (as in Item 5), the elevated PV support structures must be assigned as Risk Category IV.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Where ground-mounted PV panel systems are already designed and constructed as Risk Category I (one), this proposal will neither increase nor decrease the cost of construction. Where additional clarity is provided by this proposal, there could be projects where the cost of construction is decreased.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved based on the proponent request based on previous committee actions. (Vote: 14-0)

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1604.5

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

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.

RISK CATEGORY	NATURE OF OCCUPANCY
	~~*Ground-mounted photovoltaic (PV) panel systems*.~~
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000.[a] Power-generating stations with individual power units ~~not smaller than 100 MW~~ rated $75MW_{AC}$ or greater, 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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. Power-generating stations and other public utility facilities required ~~for compliance~~ 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.

RISK CATEGORY	NATURE OF OCCUPANCY
a.	For purposes of occupant load calculation, occupancies required by Table 1004.5 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 that 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.

Commenter's Reason: ASCE 7-22 Section 15.5.4 states: “Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbomachinery.” Commentary to Section 15.5.4 states: “Electrical power plants closely resemble building structures, and their performance in seismic events has been good.”
It is clear that IBC Table 1604.5 and ASCE Section 15.5.4 were not written with renewable energy facilities in mind. The term "power generating station" is undefined and ambiguous in the 2021 IBC, and it has no threshold assigned to it. This PC seeks to establish a threshold on the term "power generating station" that is consistent with the original intent of the term in the IBC and in ASCE 7. Note 75 MWac is a better threshold than 100 MW for the smallest power-producing unit of a power generating station, as 75 MW is established in North American Electric Reliability Corporation Docket No. RR15-4-000, Order on Electric Reliability Organization Risk Based Registration Initiative and Requiring Compliance Filing (Issued March 19, 2015). The smallest power-producing unit of a renewable energy facility could be considered as one inverter, or could be one wind turbine.

Bibliography:

North American Electric Reliability Corporation Docket No. RR15-4-000
ORDER ON ELECTRIC RELIABILITY ORGANIZATION RISK BASED REGISTRATION INITIATIVE AND REQUIRING COMPLIANCE FILING
(Issued March 19, 2015)
https://www.ferc.gov/sites/default/files/2020-05/E-3_18.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of PC and original code change proposal is no change in cost, as it formalizes the assignment of RC for the vast majority of renewable energy facilities.

Public Comment 2:

IBC: TABLE 1604.5

Proponents: Tom Vinson, representing American Clean Power Association (tvinson@cleanpower.org); Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

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. ~~*Ground-mounted photovoltaic (PV) panel systems*.~~
II	Buildings and other structures except those listed in Risk Categories I, III and IV. <u>Wind turbine generator systems (WTGS) not included in *Risk Category* IV.</u>
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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. Group I-2, Condition 1 occupancies with 50 or more care recipients. Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000.[a] Power-generating stations ~~with individual power units not smaller than 100 MW,~~ 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:

RISK CATEGORY	NATURE OF OCCUPANCY
	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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. Power-generating <u>stations</u> and other public utility facilities required~~ for compliance~~ as emergency backup facilities for *Risk Category* IV structures. <u>Wind turbine generator systems (WTGS) paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings.</u> 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 1004.5 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

RISK CATEGORY	NATURE OF OCCUPANCY
	explosive materials is permitted to be reduced to Risk Category II, provided that 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.

Commenter's Reason:

VINSON: This proposal seeks clarity on the treatment of wind turbine generating systems in a way consistent with more than a decade of precedent while also remaining consistent with the intent of other structural proposals made during this International Building Code revision cycle to improve resilience and functional recovery of communities in the wake of natural disasters.

For more than a decade, wind turbine generators have been classified as Occupancy Category II, per the *Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures* (ASCE/AWEA RP2011). This document was co-designated by the American Society of Civil Engineers (ASCE) and the American Wind Energy Association (AWEA), and is used when classifying wind turbines. In 2012 the ICC changed from using Occupancy Category to Risk Category. Classifying a wind turbine as Risk Category II is now equivalent to the previous classification as Occupancy Category II.

Authorities Having Jurisdiction (AHJs) have approved the construction of tens of thousands of wind turbines using this standard over the last eleven years. ACP is not aware of any increase in grid failure rates, including related to natural disasters and extreme weather, which would justify any need to categorize wind turbines at a level beyond RC II given the performance of the fleet to date in terms of supporting grid reliability and community resilience as explained in more detail below. Specifying wind turbines in RC II in Table 1604.5 will help avoid confusion in the industry and among regulators and facilitate the continued transportation, construction, and operation of wind turbines to meet local, state, consumer, business, and federal demand.

Further, specifying wind turbines in RC II is consistent with maintaining community resilience and recovery. Grid reliability, including the performance of power generation facilities, is regulated by the North American Electric Reliability Corporation (NERC), which itself is regulated by the Federal Energy Regulatory Commission (FERC). Various reports on generation outages over the last two decades by FERC and NERC have not identified the structural integrity of power generation as factors.

- The U.S.-Canada Power Outage System Task Force Final Report on the August 14, 2003, Blackout in the Eastern United States and Canada identified four major causes all related to improper operation and maintenance of the transmission system by a utility in Ohio.
- A joint FERC-NERC staff report on blackouts in Arizona and Southern California on September 8, 2011, found the grid operator failed to maintain the transmission system within its system operation limits, which contributed to cascading outages.
- NERC's report on Hurricane Sandy, which made landfall on October 29, 2012, indicated "no damage was reported" to wind turbines in the impact area.
- NERC's report on Hurricane Harvey, which made landfall on August 25, 2017, found "only minimal damage" was reported at wind energy facilities and facilities other than one that were offline came back online on the next day or the day after on August 26 or 27.
- More recently, FERC-NERC issued a joint report on the February 2021 extreme cold and freeze event that led to multiple days of outages in Texas and more limited challenges in

other states that identified two major causes: (1) power generation and natural gas pipelines were not adequately winterized which led to frozen equipment and systems and (2) inadequate supplies of natural gas meant there was insufficient gas for power generation as it was being used for home heating.

In response to all the above cases, FERC and NERC have adopted various federal rules and reliability standards to address the concerns that were identified.

Even the longest power outage in U.S. history in Puerto Rico after Hurricanes Irma and Maria in September 2017 was due primarily to 80% of the transmission and distribution network being inoperable and difficult to repair given mountainous topography, rather than power generation facilities being inoperable. As a peer reviewed article in the February 2019 *IEEE Power and Energy Technology Systems Journal* found, "damage to the conventional electric power generation infrastructure was relatively minor…". A 95 MW wind farm, Puerto Rico's largest, suffered "no damage" while at the other wind farm, located near Maria's landfall, the turbine blades were damaged, but only one turbine support structure failed.

ACP's proposed amendment recognizes that geographically dispersed power generation like wind energy improves grid resilience, reliability, and recovery. If an entire wind farm ceases operation, which is rare, geographically diverse wind farms elsewhere across the state or region are still putting electrons on the grid for delivery to homes and businesses.

Further, the failure at an individual wind turbine does not mean an entire wind farm stops operating. The remaining turbines can continue to generate if the substation and transmission to the grid remains up and running which also supports resilience and recovery.

Grid operators instantaneously balance generation from various power facilities in their area to match demand. As a part of this balancing, the grid operators account for generation or transmission that is offline for maintenance, intermittent by design, or forced offline by a component or system failure or weather. In the U.S., the grid is largely operated on a regional basis, meaning grid operators ramp up and down generation over a geographically diverse area that is not impacted by a weather system the same way. Adding the geographic diversity of wind and solar, with the broad operating areas of the grid operators, supports resilience and recovery.

Further, grid operators require excess generation capacity that is well-beyond (15% or more) demand peaks (i.e. "reserve margins") to facilitate the ability to ramp up generation to meet demand and to address generator outages (both planned an unplanned).Finally, modern utility-scale wind facilities support reliability, resilience, and recovery through providing essentially reliability services to the power grid like frequency support, ramping, and voltage control as documented by the U.S. Department of Energy.

For the reasons above, ACP urges adoption of this proposal to specify that wind turbines are in RC II, consistent with ASCE/AWEA RP 2011, unless such turbines are paired with energy storage systems (ESS) and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings.

CAIN:

This public comment is intended to formalize assignment of Risk Category II for wind turbine generator systems (WTGS), in accordance with long-standing practice associated with ASCE/AWEA Recommended Practice RP2011.

This PC is associated with another PC submitted by American Clean Power (ACP). There might be one typographical error in the ACP public comment, so this PC is a backup to the ACP PC, in case the word "required" is accidentally struck from the statement about "power generating stations" under RC III. The intent is to restore the existing RC III language in 2021 IBC Table 1604.5 verbatim.

Please refer to the Reason Statement in the ACP public comment for S79-22.

Bibliography:

CAIN: A Technical Overview of ASCE/AWEA RP2011: Recommended Practice for Compliance of Large Land-Based Wind Turbine Support Structures.

https://ascelibrary.org/doi/10.1061/9780784413357.155

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

VINSON: Adoption of this amendment will not impact construction costs for wind energy as they are already designed for RC II per ASCE/AWEA RP2011.

CAIN: This PC will not increase nor decrease cost of construction of WTGS, as it only seeks to formalize RC II for wind turbines according to long-standing practice consistent with ASCE/AWEA RP2011.

Public Comment 3:

Proponents: Michael Bergey, representing Distributed Wind Energy Association (mbergey@bergey.com) requests As Submitted

Commenter's Reason: The Distributed Wind Energy Association (DWEA) supports the edits proposed by the American Clean Power Association (ACPA) because them will serve to provide parity of requirements between American-made distributed wind systems and Chinese-made solar systems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The edits proposed by ACPA will only increase the construction costs for RC IV applications and will not increase the costs of the vast majority of distributed wind installations because they are currently designed for RC II.

S81-22

IBC: 1604.5, 1604.5.1, 1604.5.2 (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Building Code

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.

> **Exception:** The assignment of buildings and structures to Tsunami *Risk Categories* III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same *risk category*, it shall be assigned the classification of the highest *risk category* corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher *risk category*, both portions shall be assigned to the higher *risk category*.

> **Exception:** Where a *storm shelter* designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the *risk category* for the normal occupancy of the building shall apply unless the *storm shelter* is a designated emergency shelter in accordance with Table 1604.5.

Add new text as follows:

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as *Risk Category* I.
2. *Ground-mounted PV panel systems* shall be assigned as *Risk Category* I.
3. *Elevated PV support structures* other than those described in Items 4 and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.
6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as *Risk Category* IV.

Reason: IBC Section 1604.5 and IBC Table 1604.5 are presently silent for assignment of risk category for all types of photovoltaic (PV) installations. This is a serious gap that still exists in the IBC, even as many other PV provisions in the I-codes have matured over several cycles.
The problem this proposal seeks to resolve is confusion and gross inconsistencies regarding the assignment of risk categories for PV projects. With zero guidance in the IBC, AHJs and other code-enforcing authorities are left to make up their own rules and their own policies, based on their own personal opinions and interpretations. While there is broad agreement on several of these topics, there are outlier cases where the most stringent AHJs create interpretations that increase the cost of construction arbitrarily. With a code that is silent, industry stakeholders and permit applicants have no recourse other than to attempt a negotiation at the building department counter with each AHJ or sometimes with each project.

As there are several primary types of structures used to support PV panels, it is a serious gap in the IBC to be entirely silent on assignment of risk category for these primary applications. Justification is provided here for each of the six categories in this proposal. Note these line items are based on the following definitions. The first definition has appeared in several cycles of the IBC.

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

During Group A proceedings in 2021, Proposal G193-21 was approved As Submitted, creating two new definitions that are foundational to the assignment of risk category.

> **PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND-MOUNTED.** An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.

PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED. An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.

Justification by proposal line item is provided as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as Risk Category I (one).

We hope all stakeholders can agree that a ground-mounted PV panel system installed in the back yard behind someone's home does not need to be anything other than Risk Category I (one), as it represents "a low hazard to human life in the event of failure."

2. *Ground-mounted PV panel systems* shall be assigned as Risk Category I (one).

Fundamentally, ground-mounted PV panel systems meet the description of Risk Category I, as they "represent a low hazard to human life in the event of failure."

Unfortunately, the Solar Energy Industries Association (SEIA) is aware of a broad range of interpretation by local authorities regarding proper assignment of Risk Category for ground-mounted PV panel systems. This is especially true -- and especially impactful -- for large-scale (often referred to as "utility scale") ground-mounted PV facilities. Given the same set of construction drawings, different building department staff can reach different conclusions, based on different rationale. Different building departments have reviewed projects that are fundamentally the same design, and determined it was Risk Category I, or Risk Category II, or Risk Category III. A few reviewers have even claimed the same design should be assigned as Risk Category IV. Owing to this broad range of opinions and beliefs, the solar industry cannot design a large-scale solar facility without first asking the building code official to make this determination, and the design features and associated cost of construction of a solar facility are therefore dependent on individual opinions and beliefs of reviewers. This is far too subjective.

This inconsistency in the assignment of risk category for ground-mounted PV systems is sometimes based on the Risk Category III description that reads: "Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV." Unfortunately, there is no definition in the IBC for "power generating stations," so it has no distinct meaning and no consistent interpretation. Is a ground-mounted PV system in the back yard of a residential property a "power generating station"?

With no definition found in the IBC, we can search ASCE 7-16 and find Section 15.5.4.1, which states: "Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbo machinery." While ASCE 7-16 Table 1.5-1 does not use the term "power generating station" or "electrical power generating station," the description of Risk Category III includes "Buildings and other structures … with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of failure." It is clear that the original intent of "power-generating stations" as Risk Category III structures was based on large power-generating units such as turbines and was never intended to apply to individual PV panel systems that had not yet scaled at the time this language was created.

ASCE 7-16 Commentary C1.5 states in part: "Risk Category III ... has also included structures associated with utilities required to protect the health and safety of a community, including power generating stations and water treatment and sewage treatment plants. ... Failures of power plants that supply electricity on the national grid can cause substantial economic losses and disruption to civilian life when their failures can trigger other plants to go offline in succession. The result can be massive and potentially extended power outage, shortage, or both that lead to huge economic losses because of idled industries and a serious disruption of civilian life because of inoperable subways, road traffic signals, and so forth."

IMPORTANT: It is extremely important to note there is a fundamental difference between the physical behavior of conventional turbine power plants and PV facilities. For example, if one reactor shuts down at a nuclear power plant, over 1 gigaWatt of power production can be lost at once. The physical behavior of ground-mounted PV facilities is not the same as turbine-based power generating stations. Where failures in PV facilities have been observed – except in the most extreme cases during hurricanes Irma and Maria -- they are typically localized failures that do not shut down the entire plant.

This behavior is described in future ASCE 7-22 Commentary Section C32.5.2.1, which states in part: "Large-scale photovoltaic facilities can cover hundreds of acres of land, yet they are composed of hundreds or thousands of small, structurally independent 'tables' of PV panels, each with their own independent foundation system. The PV panels on these independent nonbuilding structures are linked with electrical conductors to central inverters that convert DC power to AC power. Large-scale PV facilities can have dozens to hundreds of independent central inverters. If an electrical fault is detected, only the inverter associated with that fault is shut down, and the remainder of the facility remains operational. The entire PV facility will shut down only if the electrical substation is shut down, or if the system otherwise detects a loss of the AC signal from the grid. Substations and grids are outside the scope of ASCE 7.

While there is little data of tornado strikes on large-scale PV facilities, in two known cases the damage from a tornado strike was isolated to localized damage. These facilities typically remain operational with localized damage. For ground-mounted photovoltaic installations, the effective plan area A_e should be the size of the largest structurally independent nonbuilding structure supporting PV panels."

Further, PV panel systems are by their nature an intermittent power source. They convert sunlight to electricity, producing power during daylight hours only. Photovoltaic power systems do not cause substantial economic losses and disruption to civilian life when they stop producing power during night-time hours. We acknowledge that the addition of Energy Storage Systems (ESS) is changing this part of the conversation. However, the addition of ESS does not change the fact that where structural failures have occurred in ground-mounted PV panel systems (except as noted), those failures have been localized and did not trigger a complete shut-down of a power plant. Where electrical faults are detected, individual inverters can shut down portions of a power plant, without any disruption to civilian life. Therefore, they do not meet the IBC or ASCE 7 criteria for Risk Category III.

There are other considerations that have been brought up for discussion.

Some AHJs have expressed an opinion that ground-mounted PV systems can be assigned as Risk Category I only if they are enclosed by a fence. While most large-scale PV facilities are in fact enclosed within a fence, they are simply not facilities open to the public. They can be accessed only by authorized personnel, who are keenly aware of behavioral conditions during weather events. It is not rational to assign an increased risk category and associated increase in cost of construction to protect possible trespassers. In a different case, with small projects located at school sites, there could be provisions for keeping students and other unauthorized people away from PV systems, but this is independent of the assignment of risk category.

In another deviation from the norm, at least one AHJ requires an increase of risk category based on proximity to highways, schools, or residential developments, with an apparent rationale that a dislodged PV panel could become airborne and cause injury at some distance away from the PV facility after being carried by high winds. In this case, the concern of the AHJ is one failure mode only – panel dislodgement. It would be far more rational to refer to Failure Modes and Effects (FMEA) analysis to focus on the root cause of that one failure mode, and to then solve the problem directly. It is not rational to use a very indirect approach of arbitrarily increasing the risk category of the entire facility because of concern about one failure mode, thereby increasing the structural loads and increasing the cost of the PV facility – perhaps without even solving the problem.

It is true that dislodgement of PV panels has been observed in some cases. It is also true that dislodgement of PV panels has led to progressive failure, as observed in at least one catastrophic failure during a hurricane event. Focused work is underway today to address that identified risk. Attachment of PV panels to the superstructure is being considered by the recently formed ASCE Solar PV Structures Committee. Recommendations are expected to be published in the future Manual of Practice. This is a problem to be solved that is independent of assignment of risk category.

There are other factors that have been identified in forensic studies, which are usually conducted under Non-Disclosure Agreements (NDAs). Work is underway to gather data that can be anonymized and aggregated, in an effort of continual improvement. Some of this work is being funded under a grant by the U.S. Department of Energy. Members of the structural engineering community who are deeply involved in solar projects are engaged in these efforts.

There are other factors that can contribute to increased reliability and resilience of PV facilities. For example, better consideration of gust effect factor and topographic factors; and a growing knowledge base from boundary layer wind tunnel studies; as well as design, specification, installation, and maintenance of components. It is both more rational and more economical to focus directly on resolving specific issues. It is not rational to believe we can increase risk category and wind loads until problems are nonexistent.

For any situation where project owners or financiers desire enhanced performance beyond code-minimum provisions for safety, a performance factor could be developed to voluntarily increase structural loads, but this should be independent of code-prescribed assignment of risk categories or methods for determining minimum structural loads.

3. *Elevated PV support structures* other than those described in Items 4 and 6 shall be assigned as Risk Category II (two).

The newly defined term for elevated PV support structures will make it easier to clarity the assignment of risk category. Elevated PV support structures are often constructed on the ground surface over parking spaces. In this application, the elevated PV support structures are not using any space that is not already used as a parking lot, and they provide the added benefit of providing shade for vehicles. Elevated PV support structures can also be constructed on the ground surface to provide shade for other uses, such as picnic areas. In all of these cases other than described in Items 4 and 6, elevated PV support structures meet the criteria and intent for Risk Category II.

There are also some emerging agricultural uses, sometimes referred to as “agri-voltaics.” As one example, elevated PV support structures have been built over cranberry bogs. Although there could be an exception for agricultural use, for simplicity this proposal is not seeking to treat agricultural uses differently than the more-common installations assigned as Risk Category II.

4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.

This concept is widely accepted by industry and AHJs and should not be controversial. Where PV panel systems are mounted on building roofs, whether attached or unattached, they shall be assigned as the same risk category as the building on which they are mounted. Elevated PV support structures have been installed on top of buildings along with vegetative roof features, and on top of parking garages over parking spaces. In any of these cases, PV structures must be designed to at least the same risk category as the building on which they are installed.

5. *PV panel systems* and *elevated PV support structures paired* with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for Risk Category IV (four) buildings shall be assigned as Risk Category IV (four).

The intermittent nature of power generation makes PV panel systems and elevated PV support structures an extremely unlikely choice as an on-site, sole source of required emergency backup power for a Risk Category IV structure. We believe most essential services facilities are still using fuel-powered (usually diesel) generators and a stock of fuel for backup power. However, with increasing adoption of Energy Storage Systems (ESS), it is conceivable that PV paired with ESS could be a sole source of required backup power.

Where PV plus ESS is the only direct source of backup power for an essential services facility – with a transfer switch or other equipment enabling it to operate independently from the grid during a time of grid power outage – it shall be assigned as Risk Category IV. If PV plus ESS is not designed to operate in the event of grid power outage, then it need not be Risk Category IV. This assignment of risk category can also apply when power switching enables the use of either the PV + ESS or a generator interchangeably.

6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as Risk Category IV (four).

There could be cases where elevated PV support structures are installed on the same site as a Risk Category IV building, over surface parking spaces that are designated for emergency services vehicles. Whether or not those elevated PV support structures are serving as part of a backup power source (as in Item 5), the elevated PV support structures must be assigned as Risk Category IV.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds clarity for assignment of risk category. The proposal does not increase the cost of construction, and in some cases could decrease the cost of construction.

S81-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in Items 1 and 5 shall be assigned as *Risk Category* II ~~I~~.
3. *Elevated PV support structures* other than those described in Items 4 , 5, and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.
6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as *Risk Category* IV.

Committee Reason: Approved as modified as the proposal provides needed guidance for the determination of Risk Category for PV panel systems. The committee did express concerns that item 6 of section 1604.5.2 could need rewording for clarity. The modification aptly assigns the noted items to Risk Category II. (Vote: 8-5)

S81-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1604.5.2

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned as *Risk Category* ~~II~~ I.
3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.
6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as *Risk Category* IV.

Commenter's Reason: While we are generally pleased with the outcome of the CAH for S81-22, we are concerned about the unsubstantiated change in Risk Category for ground-mounted PV panel systems in the As Modified version approved by the Structural Committee. The modification made some needed editorial changes, but also increased the Risk Category of most ground-mounted PV systems from Risk Category I to Risk Category II.
We are well aware that IBC Table 1604.5 describes the Nature of Occupancy for RC I as "Buildings and other structures that represent a low hazard to human life in the event of failure." We are also well aware that Table 1604.5 describes RC III as "Buildings and other structures that represent a substantial hazard to human life in the event of failure," but includes "Power generating stations" in the list of examples of Risk Category III.

As the table is presently silent on renewable energy facilities, that is all users of the IBC have in order to make an assignment of RC. If we check ASCE 7-22, we find seismic Section 15.5.4 which states: "Electrical power-generating facilities are power plants that generate electricity by steam turbines, combustion turbines, diesel generators, or similar turbomachinery." Commentary to Section 15.5.4 states: "Electrical power plants closely resemble building structures, and their performance in seismic events has been good." It is clear that IBC Table 1604.5 and ASCE Section 15.5.4 were not written with renewable energy facilities in mind. Solar PV facilities are usually governed by wind or snow, not seismic forces.

Given these facts, decisions on assignment of risk category for large-scale PV facilities have been made thousands of times for thousands of projects across the U.S., and have been mostly consistent. Solar industry experts are well aware that given the same set of facts, the vast majority of ground-mounted PV projects have been assigned as RC I. During the CAH in Richmond, one engineer testified that he has personally been the Engineer of Record for 352 large-scale PV projects representing 9 GW of power generation (Diablo Canyon in California is 2.55 GW), and only 12 of those projects were anything other than RC I. That is approximately 96% designed, permitted, and inspected as RC I, and approximately 4% as the outliers.

On June 7, 2022, SEIA co-hosted with the Sustainable Energy Action Committee (SEAC) and the Interstate Renewable Energy Council (IREC) a 2-hour virtual Roundtable Discussion on the topic of Risk Categories for renewable energy systems such as wind and solar. Many experts in the solar and wind industries joined the Roundtable Discussion, and many expressed the same experience. Those acting as EOR – and those reviewing project plans and construction details – are almost always assigning ground-mounted PV as RC I. Wind turbines are consistently assigned as RC II, according to ASCE/AWEA Recommended Practice RP2011. During the roundtable discussion, several poll questions were presented to attendees. When asked to identify the RC assigned to their solar and wind projects, the poll results confirmed a broader sample of the same experience as the testimony in Rochester.

We are simply asking governmental voters to formalize what AHJs are already doing on 95 percent of ground-mounted PV projects when they have construction drawings right in front of them to show the actual nonbuilding structures being permitted. We believe it is counter-intuitive to hold a position that others who are engaged in PV design, permitting and inspection are making the wrong decision 95% of the time, and those who hold a 5% minority outlier position are the ones who are right.

Readers of this S81-22 public comment can find a wealth of information from experts on solar and wind facilities in public comments submitted for other proposals – especially for S76-22.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of this PC with the original proposal is to formalize what is already happening today -- that approximately 95% of ground-mounted PV systems are designed, permitted and inspected as RC I. The net effect of the Committee action alone without this PC is an increase in construction cost associated with an increase from RC I to RC II.

Public Comment# 3524

Public Comment 2:

IBC: 1604.5.2

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. <u>Except for systems or structures assigned to Risk Category III or Risk Category IV as public utility facilities,</u> ~~*Photovoltaic*~~ <u>*photovoltaic*</u> *(PV) panel systems* and *elevated PV support structures* shall be assigned <u>to</u> a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned ~~as~~ <u>to</u> *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned ~~as~~ <u>to</u> *Risk Category* II.
3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned ~~as~~ <u>to</u> *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned <u>to the same</u> ~~a~~ *risk category* ~~that is the same~~ as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned ~~as~~ <u>to</u> *Risk Category* IV.
6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned ~~as~~ <u>to</u> *Risk Category* IV.

Commenter's Reason: This public comment merely clarifies and confirms the intent of S81 as submitted and as approved by the committee. As noted in the original reason statement, PV systems and structures can be appropriately assigned to different risk categories depending on their use and the risks they pose. We agree with the proponent that it's reasonable for small, ground-mounted systems that serve individual facilities, for example, to be assigned to RC I, as S81 item 1 allows. But we expect the proponent to also agree with current Table 1604.5, which quite plainly assigns "public utility facilities" to RC III or RC IV. Surely, it is not the intent of S81 to change that rather clear rule. However, as written and approved, S81 might be read as "more specific" than Table 1604.5, so it might be improperly interpreted to supersede or override the RC III or RC IV assignment. This public comment removes that concern by merely clarifying that the six listed cases do not supersede the current Table 1604.5 assignments for "public utility facilities."
In addition, the comment makes a few editorial corrections for consistency with typical IBC wording: buildings and structures are typically assigned *to* a risk category, not *as* a risk category.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment makes no substantive change to the cost of construction relative to the original proposal as modified by committee.

Public Comment# 3176

Public Comment 3:

IBC: 1604.5.2

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned <u>to</u> a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving <u>only</u> Group R-3 buildings shall be assigned ~~as~~ <u>to</u> *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned ~~as~~ <u>to</u> *Risk Category* II.

3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned ~~as~~ to *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned ~~a~~ to the same *risk category* ~~that is the same~~ as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned ~~as~~ to *Risk Category* IV.
6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned ~~as~~ to *Risk Category* IV.

Commenter's Reason:
This public comment merely clarifies and confirms the intent of S81 as submitted and as approved by the committee. The only substantive change is the addition of the word "only" in item 1. As noted in the original reason statement, item 1 is intended for cases such as "a ground-mounted PV panel system installed in the back yard behind someone's home." We agree that RC I is appropriate for such cases. However, as written and as approved, one might misinterpret item 1 to include PV systems that serve any number or type of facility, as long as the buildings served include at least one R-3 dwelling. Surely this is not the intent. This public comment removes any confusion by confirming that item 1 applies when the building or buildings served include only such dwellings. One might argue that even this change is different from what the S81 reason statement suggested as the intent. That is, even with the public comment, one might interpret the new provision to allow RC I for ground-mounted systems that serve multiple R-3 dwellings, or even a whole subdivision or small town. That's a far cry from a panel "installed in the back yard." Even so, we are willing to accept this potential interpretation as long as the same system does not also serve commercial, institutional, multi-family residential, or other occupancies. (Note that in the case of a subdivision or other large installation, if it would be regulated as a public utility, the current Table 1604.5 already assigns it to RC III.)

In addition, the comment makes a few editorial corrections for consistency with typical IBC wording: buildings and structures are typically assigned *to* a risk category, not *as* a risk category.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment makes no substantive change to the cost of construction relative to the original proposal as modified by committee.

Public Comment# 3179

Public Comment 4:

IBC: 1604.5.2

Proponents: David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned as *Risk Category* II.
3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.
6. *Elevated PV support structures* ~~dedicated to~~ where the usable space underneath is used for parking of emergency vehicles shall be assigned as *Risk Category* IV.

Commenter's Reason: This comment affects only item 6. At the hearings, one Structural Committee member requested a clean-up of this language, and we agree that it's needed for clarity.
The intent of item 6 is to match the intent of current Table 1604.5, which assigns parking facilities for emergency vehicles to RC IV. Elevated PV structures with parking under them should be similarly assigned, even though they are not buildings. As written, however, the word "dedicated" is less clear than just using the terms already used in the definition of "elevated PV support structure." Therefore, this comment replaces the words

"dedicated to" with wording from that definition.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No substantive change relative to the original proposal.

Public Comment# 3180

Public Comment 5:

IBC: 1604.5.2

Proponents: Gwenyth Searer, representing myself (gsearer@wje.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* serving Group R-3 buildings shall be assigned as *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned as *Risk Category* II.
3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.
6. *Elevated PV support structures* in areas dedicated to parking of emergency vehicles shall be assigned as *Risk Category* IV.

Commenter's Reason: This public comment modifies Item 6 per the suggestion of one of the Committee members, who pointed out correctly that the words "in areas" is needed to make Item 6 grammatically correct. This is an extremely small change to correct a minor grammatical error in the original proposal.
That being said, I want to take this opportunity to preemptively push back against the PV industry, which I understand is marshaling opposition to the Committee-approved floor modification to the original proposal that placed ground-mounted PV panel systems into a default Risk Category II. I understand that the PV industry intends to argue (as they unsuccessfully argued at the Committee Action Hearings) that the vast majority of ground-mounted PV panel systems are designed as Risk Category I.

As I hope we all learned in elementary school, just because almost everyone is doing something does not make it right. The solar industry is still nascent, and in prior meetings, their representatives have indicated that there are "bad actors" who give the solar industry a bad name by designing systems that perform poorly. That may be; however, the building code is used to set minimum standards to achieve reasonable performance, and whether or not there are "bad actors" is irrelevant to the fact that as a matter of public policy, as the electric grid becomes more and more dependent on solar power, we want large power-producing PV facilities to be appropriately designed so that the power they produce is reliable, even after large storms, hurricanes, and other weather events. Assigning all of these facilities to Risk Category I is irresponsible in my opinion. If we allow these large power-generating facilities to be designed using Risk Category I, the industry is sufficiently competitive that the opportunity to use Risk Category I will force most if not all suppliers to drop to this lowest common denominator.

The industry has argued and continues to argue that the various failures in the industry are either due to poor design of critical components or that high winds cannot possibly damage a facility enough to prevent it from generating power. The photos of destroyed PV systems from Hurricane Maria in Puerto Rico indicate the opposite. When Puerto Ricans needed the power after the storm, these systems were unable to generate the needed power.

The following is an image from NBC News of the second-largest solar power plant in Puerto Rico after Hurricane Maria:

Photo credit: https://www.nbcnews.com/storyline/puerto-rico-crisis/bright-idea-why-some-puerto-rico-are-banking-solar-solution-n817746

To counter the example from Hurricane Maria, the industry has claimed that even if Risk Category IV had been used for the design of the system, the devastation would still have been impossibly bad. Maybe so, but designing these systems for Risk Category I assuredly increases the likelihood that a facility will be heavily damaged from environmental loads such as hurricanes.

Similar damage happened to PV systems on St. Thomas, including this 4.2-megawatt PV array, during Hurricane Irma:

Photo credit: https://www.wral.com/weather/video/16953107/ Indeed, if you google images of "solar panels damaged by wind" you will find many, many photos of damaged PV systems.

The report "Extreme Weather and Solar Projects" documented heavy damage to a 30-megawatt solar farm due to a hurricane-strength winds from Hurricane Odile, the eye of which passed 40 kilometers from the site in 2014, and the loss of 100 percent of panels at a 28-megawatt PV plant in 2016 due to hail.

Clearly these numerous failures cannot be all the result of "bad actors" in the industry.

The PV industry admits that the standard of practice for wind turbines is to use Risk Category II, but they want their ground-mount systems to be in Risk Category I. Conversely, I note that the Federal Energy Management Program (FEMP), which is a part of the US Department of Energy, has recommended that PV arrays be "classified as 'critical facilities'" in their report entitled "*Solar Photovoltaic Systems in Hurricanes and Other Severe Weather*." If the solar industry is successful at overturning the Committee's decision to require Risk Category II in favor of Risk Category I, the entire proposal should be rejected, as PV power-generating plants are more important than Risk Category I.

In at least one prior code cycle, the Committee rejected a similar proposal (S74-16) to assign Risk Category I to these structures, and the Assembly supported the Committee's decision at the Public Comment Hearings by rejecting a public comment that would have permitted use of Risk Category I.

During the most recent Committee Action Hearings, the Committee was provided testimony that made it abundantly clear that there are cost implications associated with requiring Risk Category II for ground-mounted PV panel systems. When I proposed my floor modification as a compromise public policy, the Committee agreed with this floor mod despite the testimony regarding increased costs.

I therefore ask that the Assembly uphold the Committee's action and only approve the one small change requested by a Committee member to modify Item 6.

Bibliography: *Bright Idea: Why Some in Puerto Rico Are Banking on a Solar Solution*, NBC News, November 5, 2017, available at https://www.nbcnews.com/storyline/puerto-rico-crisis/bright-idea-why-some-puerto-rico-are-banking-solar-solution-n817746 and image available at https://media-cldnry.s-nbcnews.com/image/upload/MSNBC/Components/Video/201711/nn_ggu_puerto_rico_solar_solutions_171105_1920x1080.jpg
PV Survivability from Hurricanes: Lessons Learned , September 6, 2018, by Eliza Hotchkiss, National Renewable Energy Laboratory, available at https://www.nrel.gov/state-local-tribal/blog/posts/pv-survivability-from-hurricanes-lessons-learned.html

It Is in Shambles: St. Thomas Solar Farm Destroyed by Irma, September 16, 2017, WRAL.com, available at https://www.wral.com/weather/video/16953107/

Firm Behind "Bomb Site" Solar Farm Smashed Up by Arwen Says It's Still Fixing the Problem, February 3, 2022, available at https://www.gazettelive.co.uk/news/teesside-news/firm-behind-bomb-site-solar-22944502

Solar Photovoltaic Systems in Hurricanes and Other Severe Weather, August 2018, U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Federal Energy Management Program, available at https://www.energy.gov/sites/prod/files/2018/08/f55/pv_severe_weather.pdf

Newly-built Currituck Solar Farm Damaged by Hurricane Dorian, September 2019, available at https://www.13newsnow.com/article/news/local/north-carolina/outer-banks/solar-farm-damaged-hurricane-dorian-currituck-grandy-nc/291-72435246-416c-42bc-ac7e-81c95100a769

"Wind caused extensive damage to solar panels on the property of Three Creeks Elementary School", March 14, 2019, nwi.com, The Times, available at https://www.nwitimes.com/news/local/jasper/update-weve-had-trees-falling-on-houses-trees-in-the-road-as-storm-rips-through/article_acb9ba59-2905-5f24-94eb-c652c9aaae1d.html

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Some of the provisions in the code change proposal (as modified by the Committee) will relax requirements and therefore costs for PV systems. Other provisions will increase requirements and therefore costs for PV systems. This particular public comment is merely to correct a grammatical error that one of the Committee members asked to be addressed during the public comment period, and therefore has no effect on cost.

Public Comment# 3385

Public Comment 6:

IBC: 1604.5.2

Proponents: Jonathan Siu, representing Self (jonsiuconsulting@gmail.com); David Bonowitz, representing FEMA-ATC Seismic Code Support Committee (dbonowitz@att.net) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1604.5.2 Photovoltaic (PV) panel systems. *Photovoltaic (PV) panel systems* and *elevated PV support structures* shall be assigned a *risk category* as follows:

1. *Ground-mounted PV panel systems* exclusively serving no more than one Group R-3 building~~s~~ on the same lot shall be assigned ~~as~~ to *Risk Category* I.
2. *Ground-mounted PV panel systems* other than those described in items 1 and 5 shall be assigned as *Risk Category* II.
3. *Elevated PV support structures* other than those described in Items 4, 5, and 6 shall be assigned as *Risk Category* II.
4. Rooftop-mounted *PV panel systems* and *elevated PV support structures* installed on top of buildings shall be assigned a *risk category* that is the same as the *risk category* of the building on which they are mounted.
5. *PV panel systems* and *elevated PV support structures* paired with *energy storage systems (ESS)* and serving as a dedicated, stand-alone source of backup power for *Risk Category* IV buildings shall be assigned as *Risk Category* IV.

6. *Elevated PV support structures* dedicated to parking of emergency vehicles shall be assigned as *Risk Category* IV.

Commenter's Reason:
This public comment affects item 1 only. It changes item 1 to match the intent stated in the original S81 reason statement.

We agree with the S81 reason statement that ground-mounted PV systems "installed in the back yard behind someone's home" are appropriately assigned to RC I. As written, however, the proposal would apply vaguely to any building or group of buildings that includes at least one R-3 dwelling. In other words, while the clear intent of the reason statement is to apply to very small PV systems typically serving a single family home, the proposal could be misinterpreted to allow RC I for a whole subdivision with hundreds of units, or even to a whole town with a full range of occupancies and uses, just one of which is R-3.

This public comment prevents this possible misinterpretation by noting that item 1 applies only to a single R-3 dwelling on the same lot. The term "exclusively" is necessary to confirm that the same PV system assigned to RC I is not allowed to also serve other buildings, regardless of their use or location.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Same as original proposal.

Public Comment# 3342

S82-22

IBC: 1604.8.2

Proposed Change as Submitted

Proponents: John-Jozef Proczka, representing Self (john-jozef.proczka@phoenix.gov)

2021 International Building Code

Revise as follows:

1604.8.2 Structural walls. Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces that result from the application of the prescribed *loads*. The required earthquake out-of-plane *loads* are specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to *Seismic Design Category* A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other *seismic design categories*. Required anchors in masonry walls of hollow units or *cavity walls* shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613 for earthquake design requirements.

Reason: This proposal clarifies that where wind, lateral earth pressures, or other loads are the dominant lateral in-plane or out-of-plane loads on structural walls that those walls must be anchored to resist those forces. The StEER Hurricane Michael P-VAT report Figure 17 showed Jinks Middle School's gymnasium walls on two sides completely separating and collapsing from the roof they could have been properly anchored to. https://www.weather.gov/media/tae/events/20181010_Michael/StEER_PVAT.pdf

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of wall anchorage where design currently may have incorrectly been ignoring non-earthquake loading.

S82-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as unnecessary and already covered by section 1604.2. (Vote: 8-5)

S82-22

Individual Consideration Agenda

Public Comment 1:

Proponents: John-Jozef Proczka, representing Self (john-jozef.proczka@phoenix.gov) requests As Submitted

Commenter's Reason: I urge the reader to reference the immediately preceding Section 1604.8.1 to understand where the prescribed loads wording came from and why this is needed. It's currently quite odd that anchorage for uplift and sliding forces needs to be provided to resist the prescribed loads, but then we don't restate that it also applies to lateral support. This proposal fixes that.
Currently we specifically invoke one portion of ASCE 7 for structural wall anchorage to seismic loads. That isn't the full story as many structural walls are governed by wind loads or lateral soil pressure or fluid loads. We need to fix this gap.

The committee's stated rationale is correct that this is already addressed in the general provisions of 1604.2, however this same argument can be made for all of the other items in this anchorage section, so none of them need to be stated. When only seismic loads are invoked in the way they are in the current code section - it leaves the reader with the odd impression that the other types of loads do not need to be considered when designing wall anchorage. This is a dangerous misinterpretation that does occur.

Please overturn the committee's decision so we can have 1604.8.2 align with 1604.8.1 and ensure there isn't any wiggle room out of properly anchoring structural walls.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This anchorage requirement is already present, however if the code is being misinterpreted then this change could increase the cost of construction where proper anchorage of structural walls would now be required.

S85-22

IBC: 1607.6, 1607.6.1 (New), TABLE 1607.1, ASCE/SEI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org)

2021 International Building Code

Revise as follows:

1607.6 Helipads. Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height. ~~Helipads shall be designed for the following *live loads*:~~

1. ~~A uniform *live load*, *L*, as specified in Items 1.1 and 1.2. This *load* shall not be reduced.~~

   1.1. ~~40 psf (1.92 kN/m^2) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.~~

   1.2. ~~60 psf (2.87 kN/m^2) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).~~

2. ~~A single concentrated *live load*, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated *load* is not required to act concurrently with other uniform or concentrated *live loads*.~~
3. ~~Two single concentrated *live loads*, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated *live loads*.~~

~~Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.~~

Add new text as follows:

1607.6.1 Concentrated loads. Helipads shall be designed for the following concentrated *live loads*:

1. A single concentrated *live load*, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated *load* is not required to act concurrently with other uniform or concentrated *live loads*.
2. Two single concentrated *live loads*, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum *load effects* on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated *live loads*.

Revise as follows:

TABLE 1607.1 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_0, AND MINIMUM CONCENTRATED LIVE LOADS
Portions of table not shown remain unchanged.

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
16.	Handrails, guards and grab bars		See Section 1607.9		—
17.	Helipads	Helicopter takeoff weight 3,000 lb (13.35 kN) or less	~~See Section 1607.6~~ 40	See Section 1607.6.1	Section 1607.6
		Helicopter takeoff weight more than 3,000 lb (13.35 kN)	60	See Section 1607.6.1	Section 1607.6

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2,

1 square foot = 0.0929 m^2,

1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN,

1 pound per cubic foot = 16 kg/m^3.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607.12.1.2or Item 1 of Section 1607.12.2.

c. Live load reduction is only permitted in accordance with Section 1607.12.1.3 or Item 2 of Section 1607.12.2.

Add new standard(s) as follows:

ASCE/SEI

American Society of Civil Engineers Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191

7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Reason: This proposal is a coordination proposal to bring the 2024 IBC up to date with the provisions of the 2022 edition of ASCE/SEI 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-22). ASCE 7 will be updated to the 2022 edition from the 2016 edition as an Administrative update in the 2024 I-Codes.
This proposal reorganizes both the section on helipads and the live load table entry for helipads to coordinate with the organization in ASCE 7. The reorganization also more closely follows the typical IBC format for live loads by placing the live load value in the live load table itself where ever possible.

This proposal does not change the technical requirements for helipads.

Currently the entry in the live load table for helipads is simply a pointer as it states to See Section 1607.6. This proposal moves the uniform live loads into the Live Load Table as they can be concisely listed in the table by using two rows. The helipad concentrated loads remain in Section 1607 as they have accompanying text that would not fit concisely in the table.

Section 1607.6 is also logically reorganized by adding a subsection. This way the base text addressing the requirements for identification on the helipad are placed first and the concentrated loads are placed in their own subsection.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Reorganizing text and improving coordination with ASCE 7 is not expected to effect the cost of construction.

Staff Analysis: The proposal is referencing an updated version of an existing referenced standard. Therefore, the updated version is considered an new standard. A review of the standard proposed for inclusion in the code, ASCE/SEI 7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S85-22

Public Hearing Results

This proposal includes published errata

https://cdn-www-v2.iccsafe.org/wp-content/uploads/2022-GROUP-B-CONSOLIDATED-MONOGRAPH-UPDATES-3-14-22.pdf

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the sections are reorganized to coordinate with ASCE 7-22. The committee noted that the provision would allow live load reduction where it is currently not reduceable. (Vote: 10-3)

S85-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1607.6, TABLE 1607.1

Proponents: Cole Graveen, representing Self (cwgraveen@rrj.com); Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1607.6 Helipads. Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral “3” (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

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TABLE 1607.1 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_0, AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
16.	Handrails, guards and grab bars		See Section 1607.9		—
17.	Helipads	Helicopter takeoff weight 3,000 lb (13.35 kN) or less	40[a]	See Section 1607.6.1	Section 1607.6
		Helicopter takeoff weight more than 3,000 lb (13.35 kN)	60[a]	See Section 1607.6.1	Section 1607.6

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2,

1 square foot = 0.0929 m^2,

1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN,

1 pound per cubic foot = 16 kg/m^3.

a. Live load reduction is not permitted.

b. Live load reduction is only permitted in accordance with Section 1607.12.1.2or Item 1 of Section 1607.12.2.

c. Live load reduction is only permitted in accordance with Section 1607.12.1.3 or Item 2 of Section 1607.12.2.

Commenter's Reason: S85-22 was intended to coordinate the organization and format of the helipad live load provisions in the IBC with the 2022 edition of ASCE/SEI 7. There was no intent to change the technical requirements. However, in the modifications to Table 1607.1, when the text "See Section 1607.6" was deleted and replaced with the actual live load values of 40 psf and 60 psf, Footnote a was inadvertently not added next to the live load values. This could be interpreted as a technical change when combined with the text reorganization in Section 1607.6. The text reorganization deleted the numbered items 1 through 3 which included specific text that the live load shall not be reduced.
Again, changing the live load reduction provisions for helipads was not within the intent of S85-22.

This public comment adds Footnote a next to both helipad live load values, 40 psf for helicopters with a takeoff weight of 3,000 lb or less, and 60 psf for helicopters with a takeoff weight more than 3,000 lbs. This footnote is necessary to make it clear that the helipad uniform live load values are not reducible.
Attached to this public comment is the portion of the ASCE 7-22 live load table for helipads for comparison. The ASCE 7-22 live load table no longer uses footnotes, instead there is a column that address live load reduction. In this column, entitled "Live Load Reduction Permitted?", it is clearly indicated that live load reduction for helipad live loads is not permitted.

Table 4.3-1. Minimum Uniformly Distributed Live Loads, L_o, and Minimum Concentrated Live Loads.

Occupancy or Use	Uniform, L_o psf (kN/m^2)	Live Load Reduction Permitted? (Section No.)	Multiple-Story Live Load Reduction Permitted? (Section No.)	Concentrated lb (kN)	Also See Section
Apartments (See Residential)					
Access floor systems					
Office use	50 (2.40)	Yes (4.7.2)	Yes (4.7.2)	2,000 (8.90)	
Computer use	100 (4.79)	Yes (4.7.2)	Yes (4.7.2)	2,000 (8.90)	
Armories and drill rooms	150 (7.18)	No (4.7.5)	No (4.7.5)		
Assembly areas					
Fixed seats (fastened to floors)	60 (2.87)	No (4.7.5)	No (4.7.5)		
Lobbies	100 (4.79)	No (4.7.5)	No (4.7.5)		
Movable seats	100 (4.79)	No (4.7.5)	No (4.7.5)		
Platforms (assembly)	100 (4.79)	No (4.7.5)	No (4.7.5)		
Stage floors	150 (7.18)	No (4.7.5)	No (4.7.5)		
Bleachers, folding and telescopic seating, and grandstands	100 (4.79)	No (4.7.5)	No (4.7.5)		4.14
Stadiums and arenas with fixed seats (fastened to the floor)	60 (2.87)	No (4.7.5)	No (4.7.5)		4.14
Other assembly areas	100 (4.79)	No (4.7.5)	No (4.7.5)		
Balconies and decks	1.5 times the live load for the area served. Not required to exceed 100 psf (4.79 kN/m^2)	Yes (4.7.2)	Yes (4.7.2)		
Catwalks for maintenance and service access	40 (1.92)	Yes (4.7.2)	Yes (4.7.2)	300 (1.33)	
Corridors					
First floor	100 (4.79)	Yes (4.7.2)	Yes (4.7.2)		
Other floors	Same as occupancy served except as indicated				
Dining rooms and restaurants	100 (4.79)	No (4.7.5)	No (4.7.5)		
Dwellings (See Residential)					
Elevator machine room and control room grating (on area of 2 in. by 2 in. [50 mm by 50 mm])		—	—	300 (1.33)	
Finish light floor plate construction (on area of 1 in. by 1 in. [25 mm by 25 mm])		—	—	200 (0.89)	
Fire escapes	100 (4.79)	Yes (4.7.2)	Yes (4.7.2)		
On single-family dwellings only	40 (1.92)	Yes (4.7.2)	Yes (4.7.2)		
Fixed ladders		—	—	See Sec. 4.5.4	
Garages and Vehicle Floors					4.10
Passenger vehicle garages	40 (1.92)	No (4.7.4)	Yes (4.7.4)	See Sec. 4.10.1.	
Trucks and bus garages	See Section 4.10.2	—	—	See Sec. 4.10.2.	
Emergency vehicles		—	—	See Sec. 4.10.4	
Handrails and Guard systems	See Section 4.5.1	—	—	See Sec. 4.5.1.	
Grab bars		—	—	See Sec. 4.5.2	
Helipads (See Section 4.11)					
Helicopter takeoff weight 3,000 lb (13.35 kN) or less	40 (1.92)	No (4.11.1)	—	See Sec. 4.11.2.	
Helicopter takeoff weight more than 3,000 lb (13.35 kN)	60 (2.87)	No (4.11.1)	—	See Sec. 4.11.2	
Hospitals					
Operating rooms, laboratories	60 (2.87)	Yes (4.7.2)	Yes (4.7.2)	1,000 (4.45)	
Patient rooms	40 (1.92)	Yes (4.7.2)	Yes (4.7.2)	1,000 (4.45)	
Corridors above first floor	80 (3.83)	Yes (4.7.2)	Yes (4.7.2)	1,000 (4.45)	
Hotels (See Residential)					
Libraries					
Reading rooms	60 (2.87)	Yes (4.7.2)	Yes (4.7.2)	1,000 (4.45)	
Stack rooms	150 (7.18)	No (4.7.3)	Yes (4.7.3)	1,000 (4.45)	4.13
Corridors above first floor	80 (3.83)	Yes (4.7.2)	Yes (4.7.2)	1,000 (4.45)	

continues

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal with the public comment does not change the technical requirements for helipads and as such there is no effect on the cost of construction.

Public Comment# 3188

S99-22

IBC: SECTION 106, [A] 106.1, [A] 106.2, [A] 106.3, 1607.8.5

Proposed Change as Submitted

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org)

2021 International Building Code

Delete without substitution:

~~SECTION 106~~
~~FLOOR AND ROOF DESIGN LOADS~~

~~**[A] 106.1 Live loads posted.** In commercial or industrial buildings, for each floor or portion thereof designed for *live loads* exceeding 50 psf (2.40 kN/m²), such design *live loads* shall be conspicuously posted by the *owner* or the owner's authorized agent in that part of each *story* in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.~~

~~**[A] 106.2 Issuance of certificate of occupancy.** A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.~~

~~**[A] 106.3 Restrictions on loading.** It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a *load* greater than is permitted by this code.~~

Revise as follows:

1607.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted on a durable sign in a readily visible location at the vehicle entrance of the building or other approved location ~~by the owner or the owner's authorized agent in accordance with Section 106.1.~~

Reason: This proposal addresses the concerns expressed during testimony on a similar change last cycle. S52-19 attempted to move this signage requirement back to Chapter 16. This section was moved to the administrative provisions from structural by S48-07/08 The structural committee felt that this sign did not belong with the loading provisions in Chapter 16. There was testimony stating that the signage for live loads exceeding 50 pounds was an erroneous requirement. Signage requirements do not belong in the administrative provisions and none are found in any of the Administrative requirements in any of the other codes. Therefore, this proposal to delete the sign that was considered ineffective out of Chapter 1, and add a clarification of the requirements for the vehicle loading in Section 107.7.5 where it currently exists.
This proposal is submitted by the ICC Building Code Action Committee (BCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2020 and 2021 the BCAC has held several virtual meetings open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the BCAC website at https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/building-code-action-committee-bcac/.

Cost Impact: The code change proposal will decrease the cost of construction
Eliminates signage in some areas.

S99-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the committee emphasized that the code should stay as is as the current provision for posting of live loads is appropriate. The committee expressed the proposal had merit in concept as the 50 psf trigger could be considered too low. (Vote: 9-4)

S99-22

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 106, [A] 106.1, [A] 106.2, [A] 106.3, 1607.8.5

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org) requests As Modified by Public Comment

Replace as follows:

2021 International Building Code

SECTION ~~106~~
~~FLOOR AND ROOF DESIGN LOADS~~

[A] ~~106.1~~ 1607.3.1 Live loads posted. In ~~commercial or industrial buildings~~ manufacturing, storage warehouses and stores, for each floor or portion thereof designed for *live loads* exceeding the live loads in Table 1607.1 ~~50 psf (2.40 kN/m²)~~ , , such design *live loads* shall be conspicuously posted by the *owner* or the owner's authorized agent in that part of each *story* in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

[A] ~~106.2 Issuance of certificate of occupancy.~~ ~~A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.~~

[A] ~~106.3 Restrictions on loading.~~ ~~It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a *load* greater than is permitted by this code.~~

1607.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted on a durable sign in a readily visible location at the vehicle entrance of the building or other approved location ~~by the owner or the owner's authorized agent in accordance with Section 106.1.~~

Commenter's Reason: The text as currently written in unreasonable and unenforceable.

Section 106 - Chapter 1 is an administrative chapter. Signage requirements are not an administrative item. These signage requirement should be located with the loading requirements to be consistent with the code - examples include - signage for gas detection alarms (916.9) under gas detection systems (916); occupant load posting (1004.9) with occupant loads (1004); area of refuge and two-way communication requirements (1009.9) with accessible means of egress (1009); stairway identification signage (1023.9) in exit stairways (1023); exit signs (1013) are located with exit requirements in Chapter 10; toilet room signage (2902.4) in minimum plumbing facilities (2902); elevator signage (3002.3) with the elevator provisions (3002), and heavy vehicle loading signage (1607.8.5) are are located in Heavy vehicle loads (1607.8).

Section 106.1 - Table 1607.1 does not have 'commercial' or 'industrial' buildings listed, so it is not clear where the signage is required. The weight requirement of "exceeding 50 lbs" would literally require this signage in all spaces for listed in Table 1607.1 for Item 21 , Manufacturing(125/250 lbs); Item 33, Storage warehouses(125/250 lbs); and Item 34, Stores (75, 100, 125 lbs).
The proposed wording is specific for occupancies or uses listed in Table 1607.1 and is only required where the design load is higher than the minimum. This section is relocated to the requirements for uniform live loads in the code.

Section 106.2 - Signage requirements should not be tied to receiving a certificate of occupancy.

Section 106.3 - This is unenforceable. Making sure the loading in a spaces is not exceeded is an operational issue, not a building code issue.

Section 1607.8.5 - The proposed language removes the reference to Section 106 and provides more specific information for the required signage.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This technically is a reduction in the signage requirements, but it is our understanding that this is not currently being enforced. This is not a change to the technical requirements.

Public Comment# 3031

S102-22

IBC: 1607.9.1.2, 1607.9.1.2.1 (New)

Proposed Change as Submitted

Proponents: John Grenier, representing National Council of Structural Engineers Associations (NCSEA) (jgrenier@greniereng.com); Erik Madsen, representing NCSEA (erik@madsenengineering.com)

2021 International Building Code

Revise as follows:

1607.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails , wires and cables except the handrail and the top rail, shall be designed to resist a horizontally applied concentrated load of 50 pounds (0.22 kN), distributed in accordance with Section 4.5.1.2 of ASCE 7.

Add new text as follows:

1607.9.1.2.1 Barrier Cable Systems. For wire or cable used as guard infill components of a pedestrian barrier / protection system, the wires or cables shall be tightened or stressed sufficient to prevent a sphere with a diameter equivalent to the opening limitations of Section 1015.4 from passing through the barrier when the component force is applied to the sphere. The 50 pound (0.22 kN) component force applied to an individual opening sphere may be divided by the number of wires or cables within a 12 inch (305 mm) width.

Reason: The use of barrier cable systems for guards is widely used. The criteria for how to apply the component force to design or test the cable stressing however is not currently in the code or referenced standards.
The purpose of the proposed change is to address the unique aspect of cable rail systems in order to provide guidance for the amount of tension required on the infill cables to prevent splaying of the cables beyond the code opening limitation. Currently the 50 pound infill load per ASCE 7 Section 4.5.1.2 is applied on an area not to exceed 12 in. by 12 in., including openings. If the force is applied to a flat pate applied to the cables then the effect of cables splaying will not be captured. The new text clarifies that that the load for design and testing of a cable system should be applied to the individual sphere or cone and would be reduced by the number of cables in the test area.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The intent of the code change is to capture the state of the practice for cable systems and properly designed systems already meet the proposed changes.

S102-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as this issue needs to apply consistently to all infill systems. The committee recommended that the interested parties work together to offer a public comment update. (Vote: 13-0)

S102-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1607.9.1.2, 1607.9.1.2.1

Proponents: Erik Madsen, NCSEA, representing NCSEA (erik@madsenengineering.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1607.9.1.2 Guard infill component loads. ~~Balusters, panel fillers and g~~ Guard infill components, including ~~all rails,~~ balusters, panel fillers, cables, rods, ornamental elements and all rails ~~wires and cables~~ except the handrail and the top rail, shall be designed to resist a horizontally applied concentrated load of 50 pounds (0.22 kN), distributed in accordance with Section 4.5.1.2 of ASCE 7. The 50-pound load may be divided by the number of components within 12 inches perpendicular to the direction of the load. The load shall be applied to an individual opening based on the opening limitations of Section 1015.4.

1607.9.1.2.1 Guard infill serviceability. **~~Barrier Cable Systems~~.** Guard infill components shall be designed to have adequate stiffness to ~~For wire or cable used as guard infill components of a pedestrian barrier / protection system, the wires or cables shall be tightened or stressed sufficient to~~ prevent the load from 1607.9.1.2 from passing through the guard. ~~a sphere with a diameter equivalent to the opening limitations of Section 1015.4 from passing through the barrier when the component force is applied to the sphere. The 50 pound (0.22 kN) component force applied to an individual opening sphere may be divided by the number of wires or cables within a 12 inch (305 mm) width.~~

Commenter's Reason: Based on the discussion during the hearings, the public comment is intended to address the concerns raised by different members of the industry.
The current proposed changes address the following previously received comments:

1) Updates guard component loads title to address the intended load is to be applied to "infill" components

2) Updates list of components

3) Provides a method for calculating loads on additional components. The ASCE method is based on applying 50 pounds over a one-square foot area. This text allows the engineer to reduce the load of 50-pounds in the common case where individual guard components are spaced at 4" on center. In the example where pickets or cables are at 4" on center, the load may be reduced such that 50 lbs x 4" o.c. / 12" = 16.7 lbs per component. This appears to be a common practice, but is not codified.

4) Provides a reference pointer to Section 1015.4 discussing guards

5) The serviceability section provides resistance criteria to prevent infill spread. Where thin pickets, cables or other flexible guard components are installed, there is currently no method to qualify restraint. While elements may be placed at 4" on center and meet the letter of the law, the code must provide a way of keeping the elements from spreading wide enough that they negate the intent. This serviceability criteria speaks to that issue and corrects the gap in the code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal and public comment are intended to address the application of the component load., and not change the cost of construction for properly designed systems.

Public Comment# 3441

Public Comment 2:

IBC: 1607.9.1.2, 1607.9.1.2.1, 1607.9.1.2.1 (New), 1607.9.1.2.2 (New)

Proponents: Thomas Zuzik Jr, representing Feeney Inc. (coderep@railingcodes.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1607.9.1.2 Guard infill component loads. All guard infill components except for the top rail and handrail shall meet the following loads. These loads shall not be applied simultaneously.
~~Balusters, panel fillers and guard infill components, including all rails, wires and cables except the handrail and the top rail, shall be designed to resist a horizontally applied concentrated load of 50 pounds (0.22 kN), distributed in accordance with Section 4.5.1.2 of ASCE 7.~~

~~1607.9.1.2.1 Barrier Cable Systems~~. ~~For wire or cable used as guard infill components of a pedestrian barrier / protection system, the wires or cables shall be tightened or stressed sufficient to prevent a sphere with a diameter equivalent to the opening limitations of Section 1015.4 from passing through the barrier when the component force is applied to the sphere. The 50 pound (0.22 kN) component force applied to an individual opening sphere may be divided by the number of wires or cables within a 12 inch (305 mm) width.~~

1607.9.1.2.1 Horizontally applied concentrated load. A horizontally applied concentrated load of 50 pounds (0.22 kN) designed in accordance with Section 4.5.1.2 of ASCE 7.

1607.9.1.2.2 Cone. A horizontally applied concentrated load of 16.5 pounds (0.0734 kN) from a cone passing through the guard where openings exist in the guard infill. The cone shall have a diameter and height both equal to the applicable infill opening limitation of Section 1015.4.

Commenter's Reason: This modification by public comment (P.C.) further builds on the original proposal by first applying the requirements to all

infill components, not just wire cables. Additionally, this P.C. further defines and establishes the basis for the 16.5 pound load presented in this modification by public comment and the justification for the penetration cone designation.
In addition to the information and documentation presented in this published reason statement; the proponent of this P.C. has established a url web address; fore-which additional documentation and videos will be available for review for a more in-depth explanation and simplification of the documentation. For viewing see https://www.feeneyinc.com/S102-22 and this documentation will be updated throughout the remainder of this Part B cycle.

ORIGINAL S102-22 PROPOSAL

THE proponents of the original proposal began with wire cables, this public comment builds on the true intent of the original proposal by adding a guard infill deflection requirement into the model code based on a published ASTM testing method written specifically for the testing of infill deflection within metal guard systems and expanded from the wire cables, by applying the method to all guard infill material types.

The first part of the modification by public comment to the original text of 1607.9.1.2 is to separate the charging statement to apply to the now two different guard infill load requirements. The first being the breakout of the original text for the design of the 50lbs over a one square foot area, as per ASCE7 Section 4.5.1.2 into a new sub section now titled 1607.9.1.2.1. and then revising the text for wire cable infill spreading in the original proposal, to follow the ASTM standard E935-00 PART D, as the method for all guard infill, based on the simplified text proposed in this public comment in the new section 1607.9.1.2.2.

ESTABLISHED ASTM TESTING METHOD

In the published edition of ASTM Standard E935-00, the method for testing guard infill deflection is provided and titled as; "Test Method D – Application of Horizontal Static Load to Determine Resistance to Cone Penetration by Infill Area of Baluster and Panel Railing Systems."

In this standard there are two specific parameters that are definitively established for testing the deflection of guard infill. The first being the use of a penetrate cone, not a sphere, and the second is the size of the penetration cone to be 25-percent larger than the maximum permissible spacing between balusters and other infill elements. Through these defined specifications in ASTM E935-00, we can validate that the spheres noted in Chapter 10 of the model IBC are simple measurement specifications, and not a load requirement. Continuing, to simplify the information for this reason statement, the E935-00 test standard follows loads established through another ASTM standard, and this is the 50lb load used for our calculations. Using this information, we establish the test method of applying a specific load to a penetration cone with a diameter of 5-inches, as it directly correlates to the base 4-inch opening limitation within the model code for guard opening limitations.

TRANSLATING THE PENETRATION CONE TEST METHOD TO CODE LANGUAGE

The proponents of S102-22 focused on wire cables, as they are the most scrutinized type of guard infill for infill deflection concerns with the tensioning parameters. For this reason, we are limiting the rest of our discussion for the reason statement to the most common wire cable used in the built environment 1/8-inch diameter, 1x19 stainless steel construction, one of the most flexible types of infill commonly used in guard systems today. Though this public comment proposal adds the requirement to all guard infill, by far wire cable guard infill is the most affected by the proposed new model code requirement.

The original proposal uses a prescribed method to divide a 50lb load by the number of wire cables within 12-inches to establish a minimum tension to prevent a sphere from passing. This converts into a few numbers with the first being based on 3 wire cables translating into 16.66lbs, next 4 wire cables translate into 12.5lbs and 5 wire cables translate into 10lbs. However, the original proponents didn't provide any documentation in the published reason statement as to where these numbers are derived from.

The proponent of this modification by public comment, through inhouse testing to validate engineered calculations for the 16.5lb load presented, has correlated this number for the 4-inch limit off a result from the load testing of the 5-inch cone infill penetration method established in ASTM E935-00 Part D, on 1/8-inch diameter, 1x19 wire cables installed in a sample guard system with 3-inch centerline spacing of the cables and 36-inches clear span between stabilizers. The tension of the wire cables is directly affected by the length of the wire cable, and the span of the wire cable between stabilizers. A chart is provided below in this reason statement and the website listed in this reason statement and bibliography. During the proponents inhouse testing the tension can be directly correlated to the chart listed below.

SAFE INFILL – SAFE CABLE DESIGN LOADS

The tensioning, stiffness and resistance that the guard infill preforms to is directly related to the material, and with wire cable this is directly related to safe cable design loads. With 1/8-inch diameter, 1x19 stainless steel wire cable the listed minimum break point is 1,869 lbs. Simply, the wire cable will break at approximately 1,869lbs of tension. Thus, industry-based safety factors are designated as Safe Workload and Maximum Cable Pretension for Cable Rail Installations.

The Safe Workload limit is based on 20% of the break load and Maximum Cable Pretension for Cable Rail Installations is 25% of the break load. This translates into a 373lb Safe Workload and 467lb Maximum Pretension Load for 1/8-inch diameter, 1x19 stainless steel wire cable. A chart of other cables and types are listed on the website link in the bibliography.

TRANSLATING SAFE CABLE DESIGN LOADS TO ESTABLISH THE 16.5 LBS

The myth that guard infill, their loads, and infill deflection are a product specific limitation by manufacturer is not a valid statement. When it comes to wire cables the cables and fitting hardware exceed the minimum performance requirements to meet the 16.5lb load. In actuality, the difference is in the product that supports the wire cables, simply the framework that makes up the structure holding the cables in place and in tension.

The chart shown below shows the tension required for each 1/8-inch diameter, 1x19 ss wire cable to meet the proposed 16.5lb load presented in this modification by public comment. The tensions shown in the chart are based on 3-inch centerlines for the wire cable installation. The left column provides the clear open free span between stabilizers presented against the total wire cable length. Both the wire cable's length and clear span between stabilizers directly affects the tension required to meet the loaded penetration cone designated. The chart depicts when safe workloads are exceeded based on the parameters designated in the public comment.

	Cable Length (ft)									
Free Span (in)	5	10	15	20	25	30	40	50	60	70
34.5"	208	248	261	268	272	275	278	289	337	371
36"	224	262	275	281	285	288	299	326	372	-
37.5"	240	276	289	295	307	317	329	362	-	-
39"	255	290	302	325	340	349	361	-	-	-
40.5"	270	304	336	359	373	-	-	-	-	-
42"	285	328	372	-	-	-	-	-	-	-

SUMMARY OF THE LOAD AS IT RELATES TO THE ASTM PART D CONE PENETRATION TEST METHOD

In preparing this public comment many within the building code inspection industry felt that the 4-inch limit point would be simpler to translate and understand than the 5-inch diameter designated within the ASTM Standard. As thus the load of 16.5lbs for the 4-inch limit correlates to the designated load in test standard for the 5-inch cone penetration. The load was measured on the cone when the 4-inch measurement was met, and then continued until the 5-inch cone passed through the wire cable infill.

The question became to add the additional text to the code to explain the 25% larger cone to keep the higher load designated in the ASTM standard (50 lbs), or use the directly correlated load (16.5 lbs) at the 4-inch measurement, a measurement more commonly understood with the model code. For this public comment we elected to submit a load that directly correlates with the 4-inch measurement.

Additionally, some will argue and question why a sphere is not being stipulated and in lieu of the penetration cone. However, there is no justification for a sphere over the cone, as the penetration cone is the method designated in the ASTM standard.

The website link of https://www.feeneyinc.com/S102-22 is provide for more information on this public comment.

Bibliography: ASTM Editions: ASTM E935-13ε1, ASTM E935-00 & E935-83
ASTM E935-00ε1 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for buildings[1]
ASTM E935-xx Current edition approved Aug. 1, 2021. Published September 2021. Originally approved in 1983. Last previous edition approved in 2013 as E935–13ε1.
ICC ES AC273 Current edition editorially revised May 2021. Originally approved in 2004. Last previous edition approved in June 2017.
Feeney Inc. Website: https://www.feeneyinc.com/S102-22

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Since the model code does not currently designate this new requirement, there is technically an increase in cost being a new requirement.

However, due to the limited knowledge of what tensions and clear spans are being enforced and adhered to in the adopted Jurisdictions, this proposal could also be reducing costs in overly restrictive jurisdictions. A specific cost increase or decrease is going to be directly related to how the local jurisdictions currently enforce infill deflection spread in their jurisdictions.

Public Comment# 3465

S116-22

IBC: CHAPTER 1, SECTION 108, [A] 108.1, CHAPTER 2, SECTION 202, SECTION 202 (New), CHAPTER 16, SECTION 1608, 1608.1, SECTION 1609, 1609.1.1, SECTION 1612, 1612.2, SECTION 1613, 1613.1, SECTION 1614, 1614.1, SECTION 1615, 1615.1, CHAPTER 31, SECTION 3103, 3103.1, 3103.1.1 (New), 3103.1.1, 3103.1.2, 3103.5 (New), 3103.5.1 (New), TABLE 3103.5.1 (New), 3103.5.1.1 (New), 3103.5.1.2 (New), 3103.5.1.3 (New), 3103.5.1.4 (New), 3103.5.1.5 (New), 3103.5.1.6 (New), 3103.5.1.7 (New), 3103.5.1.8 (New), 3103.5.2 (New), TABLE 3103.5.2 (New), 3103.5.3 (New), 3103.5.4 (New), 3103.5.5 (New), 3103.6 (New), 3103.7 (New), 3103.7.1 (New), 3103.7.2 (New), 3103.7.3 (New), CHAPTER 35, ANSI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org); Don Scott, representing ASCE 7 Wind Load Subcommittee (dscott@pcs-structural.com); John Grenier, representing National Council of Structural Engineers Associations (NCSEA) (jgrenier@greniereng.com); Ali Fattah, representing City of San Diego Development Services Department (afattah@sandiego.gov)

2021 International Building Code

CHAPTER 1 SCOPE AND ADMINISTRATION

SECTION 108 TEMPORARY STRUCTURES AND USES

Revise as follows:

[A] 108.1 General. The *building official* is authorized to issue a *permit* for temporary structures and temporary uses. Such *permits* shall be limited as to time of service, but shall not be permitted for more than 180 days. The *building official* is authorized to grant extensions for demonstrated cause. Structures designed to comply with Section 3103.5 shall not be in service for a period of more than 1-year unless an extension of time is granted.

CHAPTER 2 DEFINITIONS

SECTION 202 DEFINITIONS

Add new definition as follows:

PUBLIC-OCCUPANCY TEMPORARY STRUCTURE. Any building or structure erected for a period of one year or less *that support public or private assemblies*, or that provide human shelter, protection, or safety. Public-occupancy temporary structures within the confines of another existing structure (such as convention booths) are exempted from Section 3103.5.

SERVICE LIFE. The period of time that a structure serves its intended purpose. For temporary structures, this shall be the cumulative time of service for sequential temporary events which may occur in multiple locations. For *public-occupancy temporary structures* this is assumed to be a minimum of 10 years.

TEMPORARY EVENT. A single use during the service life of a *public-occupancy temporary structure* at a given location which includes its installation, inspection, use and occupancy, and dismantling.

TEMPORARY STRUCTURE. Any building or structure erected for a period of 180 days or less to support *temporary events. Tempo*rary structures include a range of structure types (*public-occupancy temporary structures*, temporary *special event structures*, tents, umbrella and other membrane structures, *relocatable buildings, temporary bleachers, etc.)* for a range of purposes (storage, equipment protection, dining, workspace, assembly, etc.).

CHAPTER 16 STRUCTURAL DESIGN

SECTION 1608 SNOW LOADS

Revise as follows:

1608.1 General. Design snow *loads* shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof *load* shall be not less than that determined by Section 1607.

Exception: *Temporary structures* complying with Section 3103.5.1.3.

SECTION 1609
WIND LOADS

Revise as follows:

1609.1.1 Determination of wind loads. Wind *loads* on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design *wind speed*, *V*, and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. *Temporary structures* complying with Section 3103.5.1.4.

The wind speeds in Figures 1609.3(1) through 1609.3(12) are basic design wind speeds, *V*, and shall be converted in accordance with Section 1609.3.1 to allowable stress design wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 4 and 5 are used.

SECTION 1612
FLOOD LOADS

Revise as follows:

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

Exception: *Temporary structures* complying with Section 3103.5.1.5.

SECTION 1613
EARTHQUAKE LOADS

Revise as follows:

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S, is less than 0.4 g.
2. The *seismic force-resisting system* of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. *Temporary structures* complying with Section 3103.5.1.6.

SECTION 1614
ATMOSPHERIC ICE LOADS

Revise as follows:

1614.1 General. *Ice-sensitive structures* shall be designed for atmospheric ice *loads* in accordance with Chapter 10 of ASCE 7. *Public-occupancy temporary structures* shall comply with Section 3103.7.3.

Exception: *Temporary structures* complying with Section 3103.5.1.7.

SECTION 1615
TSUNAMI LOADS

Revise as follows:

1615.1 General. The design and construction of *Risk Category* III and IV buildings and structures located in the *Tsunami Design Zones* defined in the *Tsunami Design Geodatabase* shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

Exception: *Temporary structures* complying with Section 3103.5.1.8.

CHAPTER 31
SPECIAL CONSTRUCTION

SECTION 3103
TEMPORARY STRUCTURES

Revise as follows:

3103.1 General. The provisions of Sections 3103.1 through ~~3103.4~~ 3103.7 shall apply to structures erected for a period of less than 180 days. Temporary *special event structures*, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *International Fire Code* . ~~Those~~ *Temporary structures* erected for a longer period of time and *public-occupancy temporary structures* shall comply with applicable sections of this code.

Exception: *Public-occupancy temporary structures* complying with Section 3103.1.1 shall be permitted to remain in service for 180 days or more but not more than 1 year when approved by the *Building Official*.

Add new text as follows:

3103.1.1 Extended period of service time. *Public-occupanc* y *temporary structures* shall be permitted to remain in service for 180 days or more without complying with requirements in this code for new buildings or structures when extensions for up to 1 year are granted by the *Building Official* in accordance with Section 108.1 and when the following conditions are satisfied:

1. Additional inspections as determined by the *Building Official* shall be performed to verify that site conditions and the approved installation comply with the conditions of approval at the time of final inspection.
2. The *Building Official* shall perform follow up inspections after initial occupancy at intervals not exceeding 180 days to verify the site conditions and the installation conform to the approved site conditions and installation requirements.
3. An examination shall be performed by a registered design professional to determine the adequacy of the *temporary structure* to resist the structural loads required in Section 3103.5.
4. Relocation of the *temporary structures* shall require a new approval by the *Building Official*.
5. The use or occupancy approved at the time of final inspection shall remain unchanged.

Revise as follows:

~~3103.1.1~~ 3103.1. 2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, *means of egress*, accessibility, light, *ventilation* and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

~~3103.1.2~~ 3103.1.3 Permit required. Temporary structures that cover an area greater than 120 square feet (11.16 m^2), including connecting areas or spaces with a common *means of egress* or entrance that are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a *permit* from the *building official*.

Add new text as follows:

3103.5 Structural requirements. *Temporary structures* shall comply with Chapter 16 of this code. *Public-occupancy temporary structures* shall be designed and erected to comply with requirements of this Section.

3103.5.1 Structural loads. *Public-occupanc* y *temporary structures* shall be classified, based on the risk to human life, health, and welfare associated with damage or failure by nature of their occupancy or use, according to Table 1604.5 for the purposes of applying flood, wind, snow, earthquake, and ice provisions. Additionally, public assembly facilities that require more than 15 min to evacuate to a safe location and any structure whose failure or collapse would endanger the public assembled near the structure, such as speaker stands or other temporary structures for public gatherings shall be classified as Risk Category III.

TABLE 3103.5.1 REDUCTION FACTORS FOR GROUND SNOW LOADS FOR PUBLIC-OCCUPANCY TEMPORARY STRUCTURES

	Service Life	
Risk Category	≤ 10 yr	>10 yr
II	0.7	1.0
III	0.8	1.0
IV	1.0	1.0

3103.5.1.1 Dead. Dead loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1606.

3103.5.1.2 Live. Live loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1607.

Exception : Where *approved, live loads* less than those prescribed by Table 1607.1 *Minimum Uniformly Distributed Live Loads, L_0, and Minimum Concentrated Live Loads* shall be permitted where shown by the *registered design professional* that a rational approach has been used and that such reductions are warranted.

3103.5.1.3 Snow. Snow loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1608 and Chapter 7 of ASCE 7. The ground snow loads, p_g, in Section 1608 shall be modified according to Table 3103.5.1.
If the *public-occupancy temporary structure* is not subject to snow loads or not constructed and occupied during winter months when snow is to be expected, snow loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for snow loads if the period of time when the public-occupancy *temporary structure* is in service shifts to include winter months.

Exception: Risk Category II *public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.2 shall be permitted to use a ground snow load reduction factor of 0.65 instead of the ground snow load reduction factors in Table 3105.1.

3103.5.1.4 Wind. Wind loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1609 and Chapters 26 to 30 of ASCE 7. The design wind load shall be modified according to Table 3103.5.2.

Exceptions

1. *Public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.1 shall be permitted to use a load reduction factor of 0.65 instead of the load reduction factors in Table 3103.5.2.
2. *Public-occupancy temporary structures* erected in a hurricane-prone region outside of hurricane season, the design wind speed shall be set at the following 3-second gust basic *wind speeds* depending on *Risk Category*:
   2.1. For *Risk Category* II use 115 mph,
   2.2. For Risk Category III use 120 mph, and
   2.3. For Risk Category IV use 125 mph.

3103.5.1.5 Flood. An Emergency Action Plan, in accordance with 3103.5.4, shall be submitted for *public-occupancy temporary structures* in a Flood Hazard Area when requested by the Building or Fire Official. *Public-occupancy temporary structures* need not be designed for flood loads specified in Section 1615 except when specifically designed as a dry floodproofed structure or designated to be occupied during a storm event per the approved Emergency Action Plan.

3103.5.1.6 Seismic. Seismic loads on *public-occupancy temporary structures* assigned to Seismic Design Categories C through F shall be determined in accordance with Section 1613. The resulting seismic loads are permitted to be taken as 75% of those determined by Section 1613. *Public-occupancy temporary structures* assigned to Seismic Design Categories A and B need not be designed for seismic loads.

3103.5.1.7 Ice. Ice loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1614, Chapter 10 of ASCE 7, with the largest maximum nominal thickness being 0.5 in, for all Risk Categories**.** When ice is expected during the occupancy of *public-occupancy temporary structures*, ice loads shall be determined for surfaces on which ice could accumulate in accordance with ASCE 7. If the *public-occupancy temporary structure* is not subject to ice loads or not constructed and occupied during winter months when ice is to be expected, ice loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for ice loads if the period of time when the temporary structure is in service shifts to include winter months.

3103.5.1.8 Tsunami. An Emergency Action Plan, in accordance with 3103.5.4, shall be submitted for *public-occupancy temporary structures* in a Tsunami Design Zone when requested by the Building or Fire Official. The *public-occupancy temporary structure* need not be designed for tsunami loads specified in Section 1615.

3103.5.2 Foundations. *Public-occupancy temporary structures* may be supported on the ground with temporary foundations when approved by the Building Official. Consideration shall be given for the impacts of differential settlement when foundations do not extend below the ground or foundations supported on compressible materials. The presumptive load-bearing value for *public-occupancy temporary structures* supported on a pavement, slab on grade or on other *Collapsible or Controlled Low Strength* substrates soils such as beach sand or grass shall be assumed not to exceed 1,000 psf unless determined through testing and evaluation by a registered design professional. The presumptive load-bearing values listed in Table 1806.2 shall be permitted to be used for other supporting soil conditions.

TABLE 3103.5.2 REDUCTION FACTORS FOR WIND LOADS FOR PUBLIC-OCCUPANCY TEMPORARY STRUCTURES

	Service Life	
Risk Category	≤ 10 yr	>10 yr
II	0.8	1.0
III	0.9	1.0
IV	1.0	1.0

3103.5.3 Installation and maintenance inspections. A qualified person shall inspect *public-occupancy temporary structures* that are assembled using transportable and reusable materials; components shall be inspected when purchased or acquired and at least once per year. The inspection shall evaluate individual components, and the fully assembled structure, to determine suitability for use based on the requirements in ESTA ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the *Building Official*. Additionally, *public-occupancy temporary structures* shall be inspected at regular intervals when in service.

3103.5.4 Emergency Action plans. When required by the *Building Official*, Emergency Action Plans shall be submitted and approved. Emergency Action Plans shall include procedures to be implemented due to flood, wind, or snow hazards, or within the tsunami design zone. The action plans shall include provisions for evacuating, securing, or dismantling *public-occupancy temporary structures*, in whole or in part, and removal to prevent damage to surrounding buildings or structures.

3103.5.5 Durability and maintenance. Reusable components used in the erection and the installation of *public-occupancy temporary structures* shall be manufactured of durable materials necessary to withstand environmental conditions at the service location. Components damaged during transportation or installation and due to the effects of weathering shall be replaced or repaired.
A qualified person shall inspect *public-occupancy temporary structures*, including components, when purchased or acquired and at least once per year, based on the requirements in ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the *building official*. Additionally, *public-occupancy temporary structures* shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.

3103.6 Serviceability. The effects of structural loads or conditions shall not adversely affect the serviceability or performance of the *public-occupancy temporary structure*.

3103.7 Controlled occupancy. *Public-occupancy temporary structures* that comply with Section 3103.5 for structural requirements do not require monitoring for controlled occupancy. *Public-occupancy temporary structures* that employ exceptions for reduced environmental loads shall employ controlled occupancy procedures as specified in this section and in accordance with ANSI ES1.7. An operations management plan conforming to ANSI E1.21 with an occupant evacuation plan shall be submitted to the *Building Official* for approval as a part of the permit documents.

3103.7.1 Wind. Wind speeds associated with the design wind loads shall be monitored before and during occupancy of the *public-occupancy temporary structure. T*he *public-occupancy temporary structure* shall be vacated in the event that the design wind speed is expected to be exceeded during its occupancy.

3103.7.2 Snow. Surfaces on which snow accumulates shall be monitored before and during occupancy of the *public-occupancy temporary structure* and any loads in excess of the design snow load shall be removed prior to its occupancy, or the *public-occupancy temporary structure* shall be vacated in the event that the design snow load is exceeded during its occupancy.

3103.7.3 Ice. Surfaces on which ice accumulates shall be monitored before and during occupancy of the *public-occupancy temporary structure* and any loads in excess of the design ice load *shall* be removed prior to its occupancy, or the *public-occupancy temporary structure* shall be vacated in the event that the design ice load is exceeded during its occupancy.

CHAPTER 35
REFERENCED STANDARDS

Add new standard(s) as follows:

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

E1.21-2013	Entertainment Technology: Temporary Structures Used for Technical Production of Outdoor Entertainment Event
ES1.7-2021	Event Safety Requirements - Weather Preparednes

Reason: There is a need for code provisions for minimum structural loads for temporary structures. In past code cycles, inappropriate references were attempted to be introduced to the International Building Code but failed due to lack of consensus within the industry. Following that failed

attempt, committee members from the adopted structural loading standard ASCE/SEI 7 *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* committed to work with building officials and industry stakeholders to develop provisions that align with the design basis for Chapter 16 and ASCE/SEI 7, as well as provide the appropriate level of risk and structural reliability to the public.
To meet the need for minimum loading provisions and deliver on their commitment, this code change proposal was developed by a diverse group of experts that have experience with the development of the ASCE/SEI 7 Standard, building officials from many jurisdictions from across the country that have experience with large events and temporary structures, and industry representatives from the US entertainment industry.

This proposal was developed by an ad hoc committee that met every month since mid-2020 and the included the following members:

- Don Scott; PCS Structural Solutions – ASCE 7 Wind Load Subcommittee
- Jennifer Goupil; ASCE/SEI Codes & Standards - ASCE 7 Main Committee
- Therese McAllister, PhD; NIST – ASCE 7 Load Combinations Subcommittee
- John Hooper; MKA – ASCE 7 Seismic Subcommittee
- John Duntemann; WJE – ASCE 7 Snow Subcommittee
- Andrew Stam; WJE – ASCE 7 Dead & Live Load Subcommittee
- Bryan Lanier; American Tower Corporation – ASCE 7 Ice Load Subcommittee
- Chris Cerino; STV – ASCE 7 Flood Load Subcommittee
- James (Greg) Soules, PhD; CBI – ASCE 7 Main Committee
- Ali Fattah; City of San Diego
- Constadino (Gus) Sirakis; City of New York

This proposal was developed in collaboration with industry stakeholders, many of whom reviewed the proposal and provided comments to the ad hoc committee; the following stakeholders were invited to collaborate, and many provided comments and input for this proposal:

- Richard Nix; Entertainment Services and Technology Assoc. (ESTA)
- Mike Nugent; ICC BCAC Chair
- Steve Kerr; National Council of Structural Engineers Associations (NCSEA)
- Kai Ki Mow; Seattle Department of Construction and Inspection
- Julius Carreon; City of Bellevue Washington
- Paul Armstrong; PCA Code Services
- Daniel Clark; Clark Reder Engineers
- William Gorlin; McLaren Engineers
- David Renn; City of Denver
- Jon Siu; Jon Siu Consulting
- Gary Ehrlich; National Association of Home Builders and ICC/PTF
- Edgar Surla; Southern Nevada Chapter of ICC

Due to the staggered nature of the ICC and ASCE 7 Standard code development processes, this IBC proposal is the first of two efforts to address the need for provisions for loads on temporary structures. The second effort includes development of a new Appendix to ASCE 7 to address temporary structures.

Following is the description and rationale for content of this code change proposal:

The International Codes regulate the construction of new buildings and temporary structures through the International Building Code (IBC) and regulate existing buildings through the International Existing Building Code (IEBC). A temporary structure is not an existing building because it is not permanent and is therefore regulated through Chapter 31 of the IBC.

Temporary Special Event Structures are regulated by the International Fire Code. However, they are a type of temporary structure and thus need to also meet the requirements of this proposed section.

Three new definitions are added for public-occupancy temporary structures, service life, and temporary event. Public-occupancy temporary structures are new buildings or structures that are used by the general public, or that support public events, where the public expects similar levels of reliability and safety as offered by permanent construction. Public-occupancy temporary structures are often assembled with re-useable components and designed for a particular purpose and defined period of time, which is defined as a temporary event when the period of time is less than one year. Public-occupancy temporary structures in service for a period that exceeds 1-year are required to comply with the IBC for new buildings. Temporary structures should not pose more risk to occupants than permanent structures, but because the code's design-level environmental loads are far less likely during a temporary event, this proposal makes adjustments to reduce the requirements for a consistent level of risk. The code change addresses the hazards in the built environment in IBC chapter 16 for public-occupancy temporary structures. The code change includes the ability to mitigate some hazards through Emergency Action Plans. Portions of temporary structures may be removed to reduce wind loads, for example.

The concept of controlled occupancy is also introduced to address cases where an environmental loading hazard cannot be reasonably mitigated and allows for actions based on a preapproved action plan that the Building Official may use to allow installations that cannot resist code prescribed loads. For example, hazard areas such as flood hazard areas and tsunami inundation zones are clearly mapped, and evacuation plans are adopted and include tsunami alert warning systems and temporary structures subject to high wind loads may be evacuated and have sections removed to reduce the wind load. The code change proposal recognizes that it may be desirable for a temporary structure to remain in service for more than 180 days, whether continuously occupied or not, and provides a process that the Building Official can follow to facilitate such an extended service period. However, after 1-year has passed, the structure is required to comply with requirements for new buildings or is removed from service by being disassembled.

DESIGN PHILOSOPHY:

Temporary structures that are occupied by the general public or that could cause injuries or loss of life by their failure require a design basis that is consistent with the risk and reliability criteria in ASCE 7. The basis of design for temporary structures needs to consider voluntary vs involuntary risk, service life, and reliability as well as the ability to reduce risk for the general public for severe weather events, as elaborated below. Therefore, temporary structures occupied by the general public are expected to have the same level of reliability (or failure rate) and performance as permanent structures.

While temporary structures are developed for use up to 180 days, many of these structures are used repeatedly at different locations. Thus, their actual service life may be on the order of 5 to 10 years. Such structures are consequently subjected to repeated assembly and dismantling with associated wear and tear. Therefore, service life for temporary structures is defined to provide a consistent basis of reliability relative to that of new buildings, and a service life of 10 years is assumed for determining structural load requirements in Section 3103.5.

Risk:

In a general sense, risk represents the potential consequences of exposure to a natural or man-made hazard in the presence of uncertainty. There are three components to risk – hazard, consequences and context – and risk-informed decisions should involve all three. The focus in structural engineering has been on the hazard (and its probability of exceedance) and structural performance in terms of failure given a hazard intensity over a structure's service life. Consequences and context are reflected indirectly through Risk Categories (or Importance Factors).

The concept of voluntary and involuntary risk assumed by the general public should be considered in the design of structures. Voluntary risk assumption occurs when people choose to undertake an activity with a known level of hazard and consequences, such as driving or flying to a destination. Involuntary risks occur when people are exposed to a hazard without understanding the potential consequences. The willingness of people to incur risk depends on whether the risk is incurred voluntarily or involuntarily (Slovic, 2000). Because people require shelter, building occupancy is an involuntary risk. The general public assumes that all structures, permanent and temporary, have been designed and constructed to provide the same level of structural safety and reliability. If a structure is designed to a lower level of safety or reliability, the general public has no means to identify or assess the difference in risk. This includes temporary structures that may not be accessible to the general public but could cause injuries or loss of life in the event of failure (e.g., special event structures such as towers, platforms, and stages). Analogies can be made to various modes of transportation, and their inherent risks; the general public is aware of differences in assumed risk and can choose a mode of transportation accordingly. In contrast, ASCE 37 was developed for temporary structures used in construction. The risk associated with these structures is generally limited to construction workers, who voluntarily accept a higher-risk environment and have training and skills for operating in a construction environment. Therefore, temporary structures that are used by or in close proximity to the general public need to have a level of reliability consistent with the other structures designed for involuntary risk.

Reliability:

Structural reliability requires the combined analysis of the probability of occurrence of the hazard and the probability that the loads caused by the hazard equal or exceed the structural resistance. Temporary structures that are used, occupied, or placed in close proximity to the general public should meet reliability targets that are consistent with those for permanent structures in ASCE, allowing for differences in service lives and other conditions of use.

ASCE 7 Table 1.3-1 presents the target reliabilities by Risk Category (RC) and failure mode (e.g., ductile vs brittle failures) for hazards other than earthquake, tsunami, or extraordinary events. The target reliabilities are presented in two formats: the mean annual failure rate and the probability of failure for a 50-yr service life, expressed in terms of reliability index, β. For example, a RC II structure with ductile, local failure modes has a target mean annual failure rate $P_F = 3.0 \times 10^{-5}$ and a 50-yr target reliability index of $\beta = 3.0$ (or $P_F = 1.43 \times 10^{-3}$ over 50 years).

WIND:

ASCE 7-16 wind hazard maps were updated to confirm the risk-based mean recurrence interval (MRI) for RC I to III and to establish a risk-based MRI for RC IV (McAllister, Wang, and Ellingwood 2018). The updated wind maps are based on a fully coupled reliability analysis that considered the hazard and structural resistance. The results for the recommended MRI for the target reliabilities are shown in Figure 3105.5.2.

Two exceptions are allowed for wind:

· An exception is allowed where controlled occupancy actions in Section 3103.7 are adopted, given that on-site management and weather forecasting capabilities allow sufficient time to reduce the risk to occupants by canceling events or reducing the wind loads through removal of wind surface area or dismantling sections of the temporary structure.

· An exception is allowed when public-occupancy temporary structures are erected in a hurricane-prone region outside of hurricane season. The wind load reduction is based on hurricane and non-hurricane wind speeds. ASCE 7 publishes wind speed maps that include both hurricane and non-hurricane winds for permanent structures. Pintar et al (2015) published maps of non-hurricane non-tornadic_wind speeds for the contiguous United States.

A study by Dasguputa and Ghosh (2019) evaluated a wind speed factor of 0.78 used by the Unified Facilities Criteria for temporary structures for 5-yr and 25-yr service lives. This study selected the 50-yr target reliabilities and associated 50-yr wind speed exceedance probabilities to evaluate the wind speed load factor for occupied temporary structures based on ASCE 7-16 wind speed maps. The ASCE 7-16 wind maps for RC I, II, III and IV structures were developed for 15%, 7%, 3% and 1.6% probabilities of wind speed exceedance. To evaluate the 0.78 wind speed factor, wind speeds at 342 locations across the country were identified for specified mean recurrence intervals (MRI). The specified MRI were determined by computing the MRI that would provide the same probability of wind speed exceedance in 5 years and 25 years as that specified for a 50-yr service life in ASCE 7, as shown in Table C3105.1.1. However, the mean recurrence rates of wind speeds, and therefore the structural reliability, are quite different from the ASCE 7 target reliabilities, as shown in Example 1. Assuming that the structural resistance is similar, a comparison of the RC II mean annual frequency for wind speeds for a 50-yr service life (1.43×10^{-3}) to that of a 5-yr service life (1.43×10^{-2}) and a10-yr service life (7.14×10^{-2}) show service life reliability ratios of 10 and 5, respectively, which do not meet the ASCE 7 target reliability criteria.

Until further analyses can be conducted, a 10-yr service life and a wind speed factor of 0.9 is deemed to provide a reasonable level of reliability, given the ability to evacuate or modify temporary structures for strong wind events.

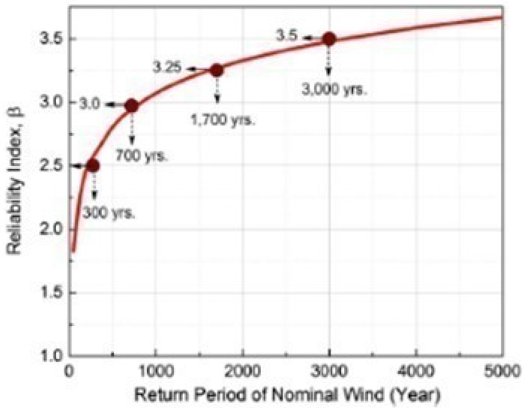

Fig. 3. Recommended mean return periods for wind maps in ASCE 7-16 ($K_{dn} = 0.85$; $\mu_{Kd} = 0.71$)

Figure C3105.5.1. ASCE 7 wind MRI versus reliability index (McAllister, Wang, and Ellingwood 2018).

Table C3105.5.1. Proposed wind speed factor for 5-yr and 25-yr service life for temporary structures by Dasguputa and Ghosh (2019) based on 50-yr service reliability criteria.

ASCE 7 MRIWind speed factor5 yr MRI25 yr MRII3000.7830150II7000.7870350III1,7000.78170850IV3,0000.783001,500

Example 1: Probability of exceedance over T yr service life for W

This example provides a comparison of probability of wind speed exceedance for service lives (T) from 5 to 25 years and Risk Category. The probability of wind exceedance is set to remain constant for each risk category; however, the mean annual frequency (P_a) can vary significantly between different values of T.

$P(W > w \text{ for } T) = 1-(1-P_a)^T = X\%$

- W – random wind speed (3-sec gust)
- w – wind speed (3-sec gust) for Mean Recurrence Interval (MRI)
- T is the service life (yr)
- P_a = 1/T is the mean annual frequency for this wind speed (1/yr)
- X is the probability of the wind speed exceedance for T

For a 50 yr service life (ASCE 7):

RC I P(W > 300 MRI in 50 yrs) = $1 – (1 - 0.0033)^{50} = 0.15$ = 15% $P_a = 3.3x10^{-3}$

RC II P(W > 700 MRI in 50 yrs) = $1 – (1 - 0.00143)^{50} = 0.069$ = 7% $P_a = 1.4x10^{-3}$

RC III P(W > 1700 MRI in 50 yrs) = $1 – (1 - 0.00059)^{50} = 0.029$ = 3% $P_a = 5.9x10^{-4}$

RC IV P(W > 3000 MRI in 50 yrs) = $1 – (1 - 0.00033)^{50} = 0.017$ = 1.7% $P_a = 3.3x10^{-4}$

For a 25 yr service life:

RC I P(W > 150 MRI in 25 yrs) = $1 – (1 - 0.0067)^{25} = 0.15$ = 15% $P_a = 6.7x10^{-3}$

RC II P(W > 350 MRI in 25 yrs) = $1 – (1 - 0.0029)^{25} = 0.069$ = 7% $P_a = 2.9x10^{-3}$

RC III P(W > 850 MRI in 25 yrs) = $1 – (1 - 0.0012)^{25} = 0.029$ = 3% $P_a = 1.2x10^{-3}$

RC IV P(W > 1500 MRI in 25 yrs) = $1 – (1 - 0.0007)^{25} = 0.017$ = 1.7% $P_a = 6.7x10^{-4}$

For a 10 yr service life:

RC I P(W > 60 MRI in 10 yrs) = $1 – (1 - 0.017)^{10} = 0.16$ = 16% $P_a = 1.7x10^{-2}$

RC II P(W > 140 MRI in 10 yrs) = $1 – (1 - 0.0714)^{10} = 0.069$ = 7% $P_a = 7.1x10^{-3}$

RC III P(W > 340 MRI in 10 yrs) = $1 – (1 - 0.00294)^{10} = 0.029$ = 3% $P_a = 2.9x10^{-3}$

RC IV P(W > 600 MRI in 10 yrs) = $1 – (1 - 0.00167)^{10} = 0.017$ = 1.7% $P_a = 1.7x10^{-3}$

For a 5 yr service life:

RC I P(W > 30 MRI in 5 yrs) = $1 – (1 - 0.0333)^{5} = 0.16$ = 16% $P_a = 3.3x10^{-2}$

RC II P(W > 70 MRI in 5 yrs) = $1 – (1 - 0.0143)^{5} = 0.069$ = 7% $P_a = 1.4x10^{-2}$

RC III P(W > 170 MRI in 5 yrs) = $1 – (1 - 0.0059)^{5} = 0.029$ = 3% $P_a = 5.9x10^{-3}$

RC IV P(W > 300 MRI in 5 yrs) = $1 – (1 - 0.0033)^{5} = 0.017$ = 1.7% $P_a = 3.3x10^{-3}$

References

Dasguputa, P. and S.K. Ghosh (2019) *An Evaluation of the Wind and Seismic Provisions of UFC 1-201-01 for Temporary Structures*, S.K. Ghosh Associates LLC**,** www.skghoshassociates.com

McAllister, T., N. Wang, and B. R. Ellingwood. 2018. *Risk-informed mean recurrence intervals for update wind maps in ASCE 7-16*, J. Struct. Eng. 144 (5). https://doi.org/10.1061/(ASCE)ST.1943-541X.0002011

Pintar, A.L., Simiu, E., Lombardo, F.T., Levitan, M. 2015. *Maps of Non-hurricane Non-tornadic Wind Speeds With Specified Mean Recurrence Intervals for the Contiguous United States Using a Two-dimensional Poisson Process Extreme Value Model and Local Regression*, NIST Special Publication 500-301, National Institute of Standards and Technology, Gaithersburg, MD https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-301.pdf

Slovic, P. (2000), *The perception of risk*. Earthscan Publications, Sterling, VA. https://www.researchgate.net/publication/232546133_The_perception_of_risk_Risk_society_and_policy_series

SEISMIC:

The requirement that the seismic loads on temporary structures assigned to Seismic Design Categories C through F are permitted to be taken as 75% of those required by Section 1613, while resulting in reduced seismic performance relative to permanent structures, is consistent with the reduction generally accepted for the evaluation/upgrade of existing buildings and would result in a similar seismic risk to the occupants. Due to the unique lack of warning associated with earthquakes, taking further reductions, even for temporary structures, results in unacceptable, involuntary risk to the occupants. Even for short time frames, the risk to the occupants should be similar, whether it's a temporary or permanent structure. Given the low seismic risk associated with Seismic Design Categories A and B locations, which results in low seismic demands, temporary structures are exempted from designing for seismic loads.

TSUNAMI:

Given that most tsunami-affected areas will have time to respond to a possible inundation, designing temporary structures for tsunami loads was deemed unnecessarily. Rather, temporary structures located in a Tsunami Design Zone will require an Emergency Action Plan that will provide details for evacuating the structure in the event of a tsunami warning.

SNOW:

When snowfall is expected during the service life of a temporary structure, snow loads are determined for surfaces on which snow can accumulate in accordance with Section 1608 and Chapter 7 of ASCE 7. In recognition of the relatively short service life of temporary structures, the ground snow load can be reduced to reflect the relatively low probability that the ASCE 7 ground snow loads will occur during the shorter service life of a temporary structure. The reduction factors of 0.7 and 0.8 in Table 3103.5.1 approximately correspond to 10-year and 20-year MRI for ground snow loads, respectively. If the service life of the temporary structure will not occur during winter months when snow is to be expected, snow loads need not be considered. Similar to wind, an exception is allowed where controlled occupancy actions in Section 3103.7 are adopted, given that on-site management and weather forecasting capabilities allow sufficient time to reduce the risk to occupants by canceling events or reducing the snow loads.

FLOOD:

Temporary structures within riverine and coastal flood zones should be evacuated at the time of loading, therefore the intent of this section is to have a defined plan to secure the structure and minimize the potential for the temporary structure to become floating debris for the surrounding environment. While local flash flooding can occur without advanced warning, the potential hazard area is much more wide-spread and not easily quantified for an enforceable Code provision as part of this cycle. For this reason, there are no requirements for temporary structures outside of a mapped flood zone.

ICE:

When ice can accumulate on a temporary structure during the service life of a temporary structure, ice loads are determined for surfaces on which ice can accumulate in accordance with Section 1614 and Chapter 10 of ASCE 7.

The 0.5-inch nominal ice thickness is based on consideration of the 10-yr and 25-yr mean recurrence interval values. Based on this, the use of a single nominal ice thickness for all locations with a Risk Category II nominal thickness greater than 0.5 inch is recommended. The gust wind speeds in Figure 10.5-1 are concurrent values, rather than extremes, so they should be used in determining wind-ice-loads for temporary ice-sensitive structures.

LOAD FACTORS/RELIABILITY:

The proposed code change is necessary to harmonize the IBC with the IFC since the latter addresses Temporary Special Event Structures and tents that are in service for up to 180 days. The recent pandemic has shown that temporary structures can be in service for more than 180 days and includes structures not regulated within the scope of the IFC.

Given the need to propose load and design criteria for publicly occupied temporary structures based on existing information and standards, the approach presented uses the load and Risk Category criteria in ASCE 7-22. Further analyses may be able to refine these criteria for the next edition of ASCE 7.

EMERGENCY ACTION PLANS:

The code change addresses all the natural hazards and associated environmental loads addressed in IBC chapter 16 and ASCE 7. However, some hazards are more frequent with a likelihood of occurrence during the in-service period or occupancy while others have a remote possibility of occurrence. Emergency Action plans are currently accepted by authorities having jurisdiction for wind loads to reduce the risk to public safety, given the reduced level of reliability relative to new buildings. Flood hazards may be seasonal for example during hurricane seasons or flash flooding is forecast in advance to allow for removal or tying down of installations. They provide the Building Official with the ability to permit a more cost effective alternative than full compliance.

DURABILITY AND MAINTENCE:

Temporary structures are designed to be assembled and disassembled and transported to many locations as components or as modules. Additionally, they may be in service during varying weather conditions. The components may be damaged during transportation or installation. Components may have been manufactured more than a decade prior to the latest use. As a consequence, and unlike a new structure that is typically constructed with new building materials and components that were not previously used, components for temporary structures need to be inspected regularly and suitability for re-use needs to be assessed. This is typically done by the installation crews, and this is similar to bleachers regulated by ICC 300 (Section 501.2). The qualified person is identified by the owner and approved by the Building Official.

Temporary structures are typically assembled utilizing transportable and reusable components that can get damaged in use or during transportation and in use and need to be verified prior to reuse. The most qualified personnel to address whether superficial corrosion is acceptable or whether bent members can be used will be the specifying engineer or the rigging supervisors or owner’s management team who tend to be most familiar with the components and the temporary structure’s system.

Cost Impact: The code change proposal will decrease the cost of construction
The proposed code change will reduce the cost of construction since it proposes reduction to the adopted loads in IBC Ch 16 and ASCE 7. The codes and standards that are in effect under the 2021 edition of the I Codes, with the exception of the International Fire Code regulations for Temporary Special Event Structures, do not provide structural loading criteria adjusted to lower loads for temporary structures that typically have a service life of a few days or weeks not to exceed 1 year.

Staff Analysis: A review of the standard proposed for inclusion in the code, ANSI ES1.7-2021 Event Safety Requirements - Weather Preparedness, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.
ANSI E1.21-2013 is already referenced in the IFC. This is simply a new occurrence of the reference in the I-Codes.

S116-22

Public Hearing Results

Committee Action: As Modified

Committee Modification:

3103.5.1.3 Snow. Snow loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1608 ~~and Chapter 7 of ASCE 7~~. The ground snow loads, p_g, in Section 1608 shall be modified according to Table 3103.5.1.

If the *public-occupancy temporary structure* is not subject to snow loads or not constructed and occupied during winter months when snow is to be expected, snow loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for snow loads if the period of time when the public-occupancy *temporary structure* is in service shifts to include winter months.

> **Exception:** Risk Category II *public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.2 shall be permitted to use a ground snow load reduction factor of 0.65 instead of the ground snow load reduction factors in Table 3105.1.

3103.5.1.4 Wind. Wind loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1609 ~~and Chapters 26 to 30 of ASCE 7~~. The design wind load shall be modified according to Table 3103.5.2.

> **Exceptions**

1. *Public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.1 shall be permitted to use a load reduction factor of 0.65 instead of the load reduction factors in Table 3103.5.2.

2. *Public-occupancy temporary structures* erected in a hurricane-prone region outside of hurricane season, the design wind speed shall be set at the following 3-second gust basic *wind speeds* depending on *Risk Category*:
   2.1. For *Risk Category* II use 115 mph,

   2.2. For Risk Category III use 120 mph, and

   2.3. For Risk Category IV use 125 mph.

3103.5.1.5 Flood. An Emergency Action Plan, in accordance with 3103.5.4, shall be required ~~submitted~~ for *public-occupancy temporary structures* in a Flood Hazard Area ~~when requested by the Building or Fire Official~~. Where an Emergency Action Plan is approved by the building and fire official, public ~~Public~~-*occupancy temporary structures* need not be designed for flood loads specified in Section 1612. ~~1615 except when specifically designed as a dry floodproofed structure or designated to be occupied during a storm event per the approved Emergency Action Plan.~~

3103.5.1.6 Seismic. Seismic design of ~~loads on~~ *public-occupancy temporary structures* assigned to Seismic Design Categories C through F shall be determined in accordance with Section 1613. The resulting seismic loads are permitted to be taken as 75% of those determined by Section 1613. *Public-occupancy temporary structures* assigned to Seismic Design Categories A and B need not be designed for seismic loads.

3103.5.1.7 Ice. Ice loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1614~~, Chapter 10 of ASCE 7~~, with the largest maximum nominal thickness being 0.5 in, for all Risk Categories**.** ~~When ice is expected during the occupancy of *public-occupancy temporary structures*, ice loads shall be determined for surfaces on which ice could accumulate in accordance with ASCE 7.~~ If the *public-occupancy temporary structure* is not subject to ice loads or not constructed and occupied during winter months when ice is to be expected, ice loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for ice loads if the period of time when the temporary structure is in service shifts to include winter months.

3103.5.4 Emergency Action plans. ~~When required by the *Building Official*,~~ Emergency Action Plans shall be submitted and approved. Emergency Action Plans shall include procedures to be implemented due to flood, wind, or snow hazards, or within the tsunami design zone. The action plans shall include provisions for evacuating and anchoring or removal of ~~, securing, or dismantling~~ *public-occupancy temporary structures,* ~~in whole or in part, and removal~~ to prevent damage to surrounding buildings or structures.

Committee Reason: Approved as modified as the proposal appropriately brings guidance for temporary structures into the IBC. The modification provides clarification, removes redundant language adds a needed language to address the Emergency Action Plan. (Vote: 13-1)

S116-22

Individual Consideration Agenda

Public Comment 1:

IBC: 3103.5, 3103.5.1

Proponents: Jonathan Siu, representing Self (jonsiuconsulting@gmail.com); Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

3103.5 Structural requirements. *Temporary structures* shall comply with Chapter 16 of this code. *Public-occupancy temporary structures* shall be designed and erected to comply with requirements of this Section.
Temporary non-building structures ancillary to public assemblies or special events structures whose structural failure or collapse would endanger assembled public shall be assigned a risk category corresponding to the risk category of the public assembly. For the purposes of establishing an occupant load for the assembled public endangered by structural failure or collapse, the applicable occupant load determination in Section 1004.5 or 1004.6 shall be applied over the assembly area within a radius equal to 1.5 times the height of the temporary non-building structure.

3103.5.1 Structural loads. *Public-occupancy temporary structures* shall be designed in accordance with Sections 3103.5.1.1 through 3103.5.1.9. ~~classified, based on the risk to human life, health, and welfare associated with damage or failure by nature of their occupancy or use, according to Table 1604.5 for the purposes of applying flood, wind, snow, earthquake, and ice provisions. Additionally, public assembly facilities that require more than 15 min to evacuate to a safe location, and any structure whose failure or collapse would endanger the public assembled near the structure,~~

~~such as speaker stands or other temporary structures for public gatherings shall be classified as Risk Category III.~~

Commenter's Reason: This public comment is being submitted to clarify the original proposal. It address non-building structures such as lighting or audio equipment stands or camera stands that are associated with public-occupancy temporary structures and special event structures, and can pose a danger to the public if they fail. The intent of this public comment is to say that they should be designed with the appropriate risk category in mind.

The current code is not clear as to how these structures should be classified. IBC Table 1604.5 only says "certain" temporary structures get assigned to Risk Category I. There is no definition of which temporary structures qualify as "certain." The importance factors associated with Risk Category I reduce the required loads these structures are designed to withstand. While Risk Category I may be appropriate for temporary structures that will not affect the public, it is inappropriate where their failure would likely inure or kill people. These types of structures are classified as non-building structures in ASCE 7, and do not fall directly under the definitions of public-occupancy temporary structures or special event structures, since they generally aren't occupied. However, they can still pose a significant danger to people who are assembled nearby, if they should fail.

The original proposal contained a requirement that these all of these ancillary structures should be assigned to Risk Category III. However, this could be viewed as being more restrictive than is required for new construction of, for example, a small theater. In addition, the original proposal did not give guidance as to how to apply the code provisions, since many times the structures are associated with outdoor assembly events whereas the current code generally envisions addressing assemblies within a building.

This public comment requires these non-building structures to be assigned a risk category that is consistent with the risk category associated with the nearby public assembly. If the nearby assembled public would be classified under Risk Category III, any stands that can fall on them should also be Risk Category III. Stands associated with smaller assemblies may get classified as Risk Category II.

In this case, "nearby" is quantified as being an area within 1.5 times the height of the non-building structure. This is consistent with recommendations from the California Building Officials association (CALBO) for the "fall zone" around buildings damaged in earthquakes when conducting ATC-20 building safety evaluations. Those recommendations suggest that building safety evaluators cordon off or barricade for a distance of 1.5 times the height of a damaged building in danger of collapsing to protect the public from building materials that can also shatter and bounce. (Ref. FEMA P-2055, *Post-disaster Building Safety Evaluation Guidance*, November 2019.) The intent of this public comment is to view the assembled public exposed to this falling hazard as being within an area where a radius equal to 1.5 times the height of the non-building structure overlaps the public assembly area. The occupant load used to determine the risk category is determined by counting fixed seats within that overlapping area (Section 1004.6) or applying the appropriate occupant load factors in Table 1004.5 to that area (Section 1004.5).

This public comment is being proposed as an addition to the three WABO TCD/SEI public comments. If all four public comments are approved, the change in Section 3103.5 in this public comment would appear as a second paragraph below the new exception, and the change in Section 3103.5.1 would not override the change in the other public comment. The final result if all four are approved would appear as follows:

3103.5 Structural requirements. Temporary structures shall comply with the structural requirements of this code. Public-occupancy temporary structures shall be designed and erected to comply with the structural requirements of this code and Sections 3103.5.1 through 3103.5.7.

Exception: Where approved, live loads less than those prescribed by Table 1607.1 shall be permitted provided a registered design professional demonstrates that a rational approach has been used and that such reductions are warranted.

Temporary non-building structures ancillary to public assemblies or special events structures whose structural failure or collapse would endanger assembled public shall be assigned a risk category corresponding to the risk category of the public assembly. For the purposes of establishing an occupant load for the assembled public endangered by structural failure or collapse, the applicable occupant load determination in Section 1004.5 or 1004.6 shall be applied over the assembly area within a radius equal to 1.5 times the height of the temporary non-building structure.

3103.5.1 Structural loads. *Public-occupancy temporary structures* shall be designed in accordance with Chapter 16, except as modified by Sections 3103.5.1.1 through 3103.5.1.6.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The original cost impact statement says this proposal will decrease the cost of construction. However, a timed egress analysis for each of these public-occupancy temporary structures will add cost. The change to eliminate that in this public comment will reduce the cost of the original proposal. The change regarding ancillary structures allows some of them to remain under Risk Category II, as opposed to being pushed to Risk Category III, and will therefore reduce costs compared to the original proposal.

Public Comment# 3028

Public Comment 2:

IBC: 3103.1.1

Proponents: Jonathan Siu, representing Washington Association of Building Officials Technical Code Development Committee (jonsiuconsulting@gmail.com); Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org); Micah Chappell, representing Washington Association of Building Officials Technical Code Development Committee (micah.chappell@seattle.gov) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

3103.1.1 Extended period of service time. *Public-occupancy temporary structures* shall be permitted to remain in service for 180 days or more without complying with requirements in this code for new buildings or structures when extensions for up to 1 year are granted by the *Building Official* in accordance with Section 108.1 and when the following conditions are satisfied:

1. Additional inspections as determined by the *Building Official* shall be performed <u>by a qualified person</u> to verify that site conditions and the approved installation comply with the conditions of approval at the time of final inspection.
2. ~~The *Building Official*~~ <u>A qualified person</u> shall perform follow up inspections after initial occupancy at intervals not exceeding 180 days to verify the site conditions and the installation conform to the approved site conditions and installation requirements. <u>Inspection records shall be kept and shall be made available for verification by the Building Official.</u>
3. An examination shall be performed by a registered design professional to determine the adequacy of the *temporary structure* to resist the structural loads required in Section 3103.5.
4. Relocation of the <u>*public-occupancy*</u> *temporary* ~~*structures*~~ <u>*structure*</u> shall require a new ~~approval by the *Building Official*~~ <u>permit application</u>.
5. The use or occupancy approved at the time of final inspection shall remain unchanged.
6. <u>A request for an extension is submitted to the building official. The request shall include records of the inspections and examination in Items 1 and 3 above.</u>

Commenter's Reason: This public comment is intended to improve the enforceability of this proposal. As written, the proposal requires the building official to track and conduct ongoing inspections of these structures after the Certificate of Occupancy is issued. Unless there is work being done that requires a permit, what happens after the CofO is issued is not normally regulated by the building official. For many jurisdictions, this would require setting up a system similar to Temporary CofOs to keep track of these and trigger the required inspections. For those jurisdiction who have an electronic permit tracking system, this is less onerous than for those who are still working in a paper system, but even with electronic permitting, setting up the system may not be a negligible effort.
The biggest changes proposed by this public comment are in Items 1 and 2. Instead of requiring the building official to track these, this public comment puts the onus on the owner and their "qualified person" to provide the additional inspections in Item 1, and the ongoing inspections in Item 2. For the ongoing inspections, the qualified person is required to keep the records, should the building official or their delegee wants to review them. These changes make the process very similar to the process for special inspections in Chapter 17, where the building official relies on a special inspector or agency for many of the details of construction.

The change to Item 4 clarifies this applies to public-occupancy temporary structures (not all temporary structures), and that the owner will need to apply for a new permit and go through the full permit process for relocated public-occupancy temporary structures, as opposed to getting an undefined "new approval" from the building official.

Regarding the new Item 6, the apparent intent of the original proposal is that the extension is granted without requiring the owner to go through the normal permit application process. This public comment clarifies the request has to be submitted to the building official, and that reports resulting from the inspections by the qualified person and the registered design professional's "examination" must be submitted along with the request. The jurisdiction's process will determine what form the request takes (written or electronic).This public comment is one of a series of three being submitted by WABO TCD and ASCE to improve this proposal. This public comment is not intended to override the editorial change being made to Section 3103.1.1 by one of the other comments (changing "when" to "where" in two places). For reference, we have developed a clean version of the proposal that incorporates all three public comments (see link below), showing how the final code language for the entire change should appear, should all three public comments be approved.

<u>https://www.cdpaccess.com/public-comment/3147/27095/files/download/3599/S116-22%20Temp%20Structures%20-%20Combined%20SIU%205-6-12%20PCs%20%28clean%29.pdf</u>

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The original proposal states the cost of construction will decrease. This public comment does not change the proposal's effect on the initial cost of construction, since it applies to ongoing maintenance and inspections after the initial Certificate of Occupancy is issued. However, the public comment will increase the costs to the owner relative the original proposal, since the owner will be required to hire/retain the "qualified person" to conduct the ongoing inspections. Because the original proposal is unclear on the qualifications of the "qualified person," and because of the variability in the size and complexity of the temporary structures being regulated, it is not possible to put an accurate dollar value on the additional

cost. But supposing the "qualified person" is an engineer who charges $300/hour for their services, and it takes 3 hours to conduct the required inspections, the cost for each inspection would be less than $1000. On the other hand, this public comment will decrease the costs for the building official's jurisdiction relative to the original proposal, since the jurisdiction won't be required to incorporate ongoing inspections and tracking into their processes and workload. The building official will only incur costs if they choose to follow up on these structures.

Public Comment# 3029

Public Comment 3:

IBC: 3103.5.1.3, 3103.5.1.4, 3103.5.1.5, 3103.5.1.7, 3103.5.1.8, 3103.5.4, 3103.5.5, 3103.7, 3103.7.1, 3103.7.2, 3103.7.3

Proponents: Jonathan Siu, representing Washington Association of Building Officials Technical Code Development Committee (jonsiuconsulting@gmail.com); Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org); Micah Chappell, representing Washington Association of Building Officials Technical Code Development Committee (micah.chappell@seattle.gov) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

3103.5.1.3 Snow. Snow loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1608. The ground snow loads, p_g, in Section 1608 shall be modified according to Table 3103.5.1.3.
~~If the *public-occupancy temporary structure* is not subject to snow loads or not constructed and occupied during winter months when snow is to be expected, snow loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for snow loads if the period of time when the public-occupancy *temporary structure* is in service shifts to include winter months.~~

> **Exception:** Risk Category II *public-occupancy temporary structures* that employ controlled occupancy ~~measures~~ <u>procedures</u> per Section ~~3103.7.2~~ <u>3103.7</u> shall be permitted to use a ground snow load reduction factor of 0.65 instead of the ground snow load reduction factors in Table 3105.1.3.

<u>Where the *public-occupancy temporary structure* is not subject to snow loads or not constructed and occupied during times when snow is to be expected, snow loads need not be considered, provided that where the period of time when the public-occupancy temporary structure is in service shifts to include times when snow is to be expected, either of the following conditions is met:</u>

1. <u>The design is reviewed and modified, as appropriate, to account for snow loads; or</u>
2. <u>Controlled occupancy procedures in accordance with Section 3103.7 are implemented.</u>

3103.5.1.4 Wind. Wind loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1609. The design wind load shall be modified according to Table 3103.5.1.4.

Exceptions

1. *Public-occupancy temporary structures* that ~~employ~~ <u>implement</u> controlled occupancy ~~measures~~ <u>procedures</u> per Section ~~3103.7.1~~ <u>3103.7</u> shall be permitted to use a load reduction factor of 0.65 instead of the load reduction factors in Table 3103.5.1.4.
2. *Public-occupancy temporary structures* erected in a hurricane-prone region outside of hurricane season, the design wind speed shall be set at the following 3-second gust basic *wind speeds* depending on *Risk Category*:
   - 2.1. For *Risk Category* II use 115 mph,
   - 2.2. For Risk Category III use 120 mph, and
   - 2.3. For Risk Category IV use 125 mph.

3103.5.1.5 Flood. ~~An Emergency Action Plan , in accordance with Section 3103.5.4, shall be required for *public-occupancy temporary structures* in a Flood Hazard Area. Where an Emergency Action Plan is approved by the building and fire official, *public*~~ <u>Public-</u>*occupancy temporary structures* need not be designed for flood loads specified in Section1612. <u>Controlled occupancy procedures in accordance with Section 3103.7 shall be implemented.</u>

3103.5.1.7 Ice. Ice loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1614 with the largest maximum nominal thickness being 0.5 in, for all Risk Categories**.** ~~If~~ <u>Where</u> the *public-occupancy temporary structure* is not subject to ice loads or not constructed and occupied during ~~winter months~~ <u>times</u> when ice is to be expected, ice loads need not be considered, provided that <u>where the period of time when the temporary structure is in service shifts to include times when ice is to be expected, either of the following conditions is met</u>:

1. ~~the~~ The design is reviewed and modified, as appropriate, to account for ice loads ~~if the period of time when the temporary structure is in service shifts to include winter months~~ ; or
2. Controlled occupancy procedures in accordance with Section 3103.7 are implemented.

3103.5.1.8 Tsunami. ~~An Emergency Action Plan, in accordance with Section 3103.5.4, shall be submitted for *public-occupancy temporary structures* in a Tsunami Design Zone when requested by the Building or Fire Official. The *public*~~ Public*-occupancy temporary* ~~*structure*~~ *structures* in a tsunami design zone need not be designed for tsunami loads specified in Section 1615. Controlled occupancy procedures in accordance with Section 3103.7, shall be implemented.

~~**3103.5.4 Emergency Action plans.** Emergency Action Plans shall be submitted and approved. Emergency Action Plans shall include procedures to be implemented due to flood, wind, or snow hazards, or within the tsunami design zone. The action plans shall include provisions for evacuating and anchoring or removal of *public-occupancy temporary structures,* to prevent damage to surrounding buildings or structures.~~

~~**3103.5.5**~~ **3103.5.4 Durability and maintenance.** [Text unchanged]

3103.7 Controlled occupancy procedures. ~~*Public-occupancy temporary structures* that comply with Section 3103.5 for structural requirements do not require monitoring for controlled occupancy.~~ Where controlled occupancy procedures are required to be implemented for ~~*Public*~~ *public-occupancy temporary structures* ~~that employ exceptions for reduced environmental loads shall employ controlled occupancy procedures as specified~~ in Section 3103.5.1, the procedures shall comply with this section and ~~in accordance with~~ ANSI ES1.7. An operations management plan ~~conforming to~~ in accordance with ANSI E1.21 ~~with an occupant evacuation plan~~ shall be submitted to the *Building Official* for approval as a part of the permit documents. In addition, the operations management plan shall include an emergency action plan that documents the following information, where applicable:

1. Surfaces on which snow or ice accumulates shall be monitored before and during occupancy of the public-occupancy temporary structure. Any loads in excess of the design snow or ice load shall be removed prior to its occupancy, or the public-occupancy temporary structure shall be vacated in the event that either the design snow or ice load is exceeded during its occupancy.
2. Wind speeds associated with the design wind loads shall be monitored before and during occupancy of the public-occupancy temporary structure. The public-occupancy temporary structure shall be vacated in the event that the design wind speed is expected to be exceeded during its occupancy.
3. Criteria for initiating occupant evacuation procedures for flood and tsunami events.
4. Occupant evacuation procedures shall be specified for each environmental hazard where the occupant management plan specifies the public-occupancy temporary structure is to be evacuated.
5. Procedures for anchoring or removal of the public-occupancy temporary structure, or other additional measures or procedures to be implemented to mitigate hazards in snow, wind, flood, ice, or tsunami events.

~~**3103.7.1 Wind.** Wind speeds associated with the design wind loads shall be monitored before and during occupancy of the *public-occupancy temporary structure. The public-occupancy temporary structure* shall be vacated in the event that the design wind speed is expected to be exceeded during its occupancy.~~

~~**3103.7.2 Snow.** Surfaces on which snow accumulates shall be monitored before and during occupancy of the *public-occupancy temporary structure* and any loads in excess of the design snow load shall be removed prior to its occupancy, or the *public-occupancy temporary structure* shall be vacated in the event that the design snow load is exceeded during its occupancy.~~

~~**3103.7.3 Ice.** Surfaces on which ice accumulates shall be monitored before and during occupancy of the *public-occupancy temporary structure* and any loads in excess of the design ice load *shall* be removed prior to its occupancy, or the *public-occupancy temporary structure* shall be vacated in the event that the design ice load is exceeded during its occupancy.~~

Commenter's Reason: This public comment is intended to coordinate, clarify, and simplify the requirements surrounding the proposed emergency action and operations management plans. As written, the proposal is confusing as to whether the emergency action plan is a separate document from the operations management plan, yet it seems that the (minimal) elements outlined in the section on emergency action plans are, or should be, included in the operations management plan. This public comment places requirements for an emergency action plan within the requirements for controlled occupancy procedures, revises the section on controlled occupancy, and makes other editorial changes to coordinate the applicable sections. Specifically:

- "Controlled occupancy measures" is replaced in the snow and wind sections (exceptions in 3103.5.1.3 and 3103.5.1.4) with "controlled occupancy procedures" to be consistent with Section 3103.7. This is intended to eliminate confusion as to whether "measures" are different from "procedures."
- Requirements for an "emergency action plan" for floods and tsunamis (3103.5.1.5 and 3103.5.1.8) is replaced with a requirement to employ controlled occupancy procedures. This is intended to make the language consistent among the sections, and coordinates with changes to 3103.7. The order of the sentences in both sections has been revised to lead off with the load (non-) requirement, since 3103.5.1 is generally about environmental loads.
- Provisions allowing controlled occupancy procedures for snow have been modified to allow for regional differences in expected snow events. The original proposal referred to "winter months," but there are areas that can expect snow events year-round.

- An allowance to implement controlled occupancy procedures is added to ice loads (3103.5.1.7) as an option to redesigning the structure if the occupancy extends into times when ice is to be expected. This makes the ice provisions parallel with snow, and coordinates this section with 3103.7.3 in the original proposal (3103.7, Item 2 in this public comment).
- Section 3103.5.4 (Emergency action plans) is deleted, since there is a requirement for an operations management plan in 3103.7, which includes an emergency action plan. In addition, the sentence regarding protection of surrounding structures not only should be part of the controlled occupancy procedures, but also fails to recognize that people should be protected from the hazards created by these structures.
- With the deletion of 3103.5.4, the section that follows (durability and maintenance) has been renumbered.
- Besides retitling the section to refer to controlled occupancy procedures, Section 3103.7 has been substantially rewritten and reformatted.
    - The first sentence stating controlled occupancy monitoring (procedures? measures?) are not required is unnecessary and in the cases of flood and tsunami, conflicts with the requirement for an emergency action plan (now part of the operations management plan). The sentence has been deleted without replacement.
    - The first modification to the next sentence simplifies and clarifies the trigger language for controlled occupancy procedures. As written, the requirement that appeared to say controlled occupancy procedures were required where any environmental load is reduced in 3103.5 conflicted with the actual provisions--only certain reductions require the procedures. This has been clarified by referring back to triggers in 3103.5.1.
    - ANSI E1.21 contains requirements for monitoring the weather and forecast for high winds, tornadoes, thunderstorms, lightning, and other "severe conditions," as well as a requirement for mitigating actions for ice and snow to be specified in the operations management plan. These appear to overlap with the originally-proposed emergency action plan. This public comment now requires an emergency action plan be included in the operations management plan, and that some additional information needs to be provided.
    - The originally-proposed wind, snow, and ice subsections of 3103.7 provide some additional guidance on mitigating activities that should be included in the operations management plan. Subsections 3103.7.1 through 3103.7.3 in the original proposal have been reformatted as numbered items in Section 3103.7, for clarity and to make the charging language simpler.
        - Subsections 3103.7.2 and 3103.7.3 have been combined in the new Item 1 since the language in each of the subsections was identical except for the hazard.
        - Subsection 3103.7.1 is now Item 2. The change in order of presentation is so the items will appear in the same order as they appear in Section 3103.5.1 (snow before wind).
        - The new Item 3 clarifies the operations management plan needs to specify what triggers evacuation for flood and tsunami events.
        - The new Item 4 requires the operations management plan to specify the procedures for evacuation, once those procedures are triggered.
        - The new Item 5 is a catch-all for any other necessary procedures, and incorporates requirements from the deleted section on emergency action plans.

This public comment is one of a series of three being submitted by WABO TCD and ASCE to improve this proposal. This public comment is intended to be melded together with the changes proposed by the other two public comments. Because this public comment is proposing very substantive changes to the original proposal, it is being submitted for separate consideration at the Public Comment Hearings. Thus, in some cases, if this public comment is approved, it will override the other public comments, and in others (particularly for editorial changes), the other public comments are intended to govern. For reference, we have developed a clean version of the proposal that incorporates all three public comments (see link below), showing how the final code language for the entire change should appear, should all three public comments be approved.

https://www.cdpaccess.com/public-comment/3147/27095/files/download/3599/S116-22%20Temp%20Structures%20-%20Combined%20SIU%205-6-12%20PCs%20%28clean%29.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The original cost impact statement says this proposal will decrease the cost of construction. This public comment clarifies and reformats the proposal, and therefore, will have no effect on the original cost impact statement.

Public Comment# 3040

Public Comment 4:

IBC: CHAPTER 2, SECTION 202, CHAPTER 31, SECTION 3103, 3103.1, 3103.1.1, 3103.5, 3103.5.1, 3103.5.1.1, 3103.5.1.2, 3103.5.1.3, 3103.5.1.4, 3103.5.1.5, 3103.5.1.6, 3103.5.1.7, 3103.5.1.8, 3103.5.2, 3103.5.3, 3103.5.5, CHAPTER 16, 1608.1, 1609.1.1, 1612.2, 1613.1, 1614.1, 1615.1

Proponents: Jonathan Siu, representing Washington Association of Building Officials Technical Code Development Committee (jonsiuconsulting@gmail.com); Jennifer Goupil, representing Structural Engineering Institute of ASCE (jgoupil@asce.org); Micah Chappell, representing Washington Association of Building Officials Technical Code Development Committee (micah.chappell@seattle.gov) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

CHAPTER 2
DEFINITIONS

SECTION 202
DEFINITIONS

PUBLIC-OCCUPANCY TEMPORARY STRUCTURE. Any building or structure erected for a period of one year or less that serves an assembly occupancy or other public use. ~~*support public or private assemblies*, or that provide human shelter, protection, or safety. Public-occupancy temporary structures within the confines of another existing structure (such as convention booths) are exempted from Section 3103.5.~~

CHAPTER 31
SPECIAL CONSTRUCTION

SECTION 3103
TEMPORARY STRUCTURES

3103.1 General. The provisions of Sections 3103.1 through 3103.7 shall apply to structures erected for a period of less than 180 days. Temporary *special event structures*, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *International Fire Code* . *Temporary structures* erected for a longer period of time and *public-occupancy temporary structures* shall comply with applicable sections of this code.

~~Exception~~ Exceptions:

1. *Public-occupancy temporary structures* complying with Section 3103.1.1 shall be permitted to remain in service for 180 days or more but not more than 1 year ~~when~~ where approved by the *Building Official*.
2. *Public-occupancy temporary structures* erected within the confines of an existing structure are not required to comply with Section 3103.5.

3103.1.1 Extended period of service time. *Public-occupancytemporary structures* shall be permitted to remain in service for 180 days or more without complying with requirements in this code for new buildings or structures ~~when~~ where extensions for up to 1 year are granted by the *Building Official* in accordance with Section 108.1 and ~~when~~ where the following conditions are satisfied:
[No change to conditions]

3103.5 Structural requirements. *Temporary structures* shall comply with ~~Chapter 16~~ the structural requirements of this code. *Public-occupancy temporary structures* shall be designed and erected to comply with the structural requirements of this ~~Section~~ code and Sections 3103.5.1 through 3103.5.7.

Exception: Where approved, live loads less than those prescribed by Table 1607.1 shall be permitted, provided a registered design professional demonstrates that a rational approach has been used and that such reductions are warranted.

3103.5.1 Structural loads. *Public-occupancy temporary structures* shall be designed in accordance with Chapter 16, except as modified by Sections 3103.5.1.1 through 3103.5.1.6. ~~classified, based on the risk to human life, health, and welfare associated with damage or failure by nature of their occupancy or use, according to Table 1604.5 for the purposes of applying flood, wind, snow, earthquake, and ice provisions. Additionally, public assembly facilities that require more than 15 min to evacuate to a safe location and any structure whose failure or collapse would endanger the public assembled near the structure, such as speaker stands or other temporary structures for public gatherings shall be classified as Risk Category III.~~

~~**3103.5.1.1 Dead.** Dead loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1606.~~

~~**3103.5.1.2 Live.** Live loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1607.~~

~~**Exception**: Where *approved, live loads* less than those prescribed by Table 1607.1 *Minimum Uniformly Distributed Live Loads,* L_o*, and Minimum Concentrated Live Loads* shall be permitted where shown by the *registered design professional* that a rational approach has been used and that such reductions are warranted.~~

~~3103.5.1.3~~ 3103.5.1.1 Snow loads. Snow loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1608. The ground snow loads, p_g, in Section 1608 shall be permitted to be modified ~~according to~~ in accordance with the ground snow load reduction factors in Table ~~3103.5.1.3~~ 3103.5.1.
If the *public-occupancy temporary structure* is not subject to snow loads or not constructed and occupied during ~~winter months~~ times when snow is to be expected, snow loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for snow loads if the period of time when the public-occupancy *temporary structure* is in service shifts to include ~~winter months~~ times when snow is to be expected.

Exception: Ground snow loads, p_g, for ~~Risk Category II~~ *public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.2 shall be permitted to ~~use~~ be modified using a ground snow load reduction factor of 0.65 instead of the ground snow load reduction factors in Table ~~3105.1.3~~ 3103.5.1.

~~3103.5.1.4~~ 3103.5.1.2 Wind loads. ~~Wind loads on *public-occupancy temporary structures* shall be determined in accordance with Section 1609.~~ The design wind load on *public-occupancy temporary structures* shall be permitted to be modified ~~according to~~ in accordance with the wind load reduction factors in Table ~~3103.5.1.4~~ 3103.5.2.

Exceptions

1. Design wind loads on ~~*Public*~~ *public-occupancy temporary structures* that employ controlled occupancy measures per Section 3103.7.1 shall be permitted to ~~use~~ be modified using a wind load reduction factor of 0.65 instead of the load reduction factors in Table ~~3103.5.1.4~~ 3103.5.2.
2. For ~~*Public*~~ *public-occupancy temporary structures* erected in a hurricane-prone region outside of hurricane season, the ~~design~~*basic wind speed* , *V*, shall be permitted to be set ~~at the following 3-second gust basic *wind speeds*~~ as follows, depending on *Risk Category*:
   2.1. For *Risk Category* II use 115 mph,
   2.2. For Risk Category III use 120 mph, and
   2.3. For Risk Category IV use 125 mph.

~~3103.5.1.5~~ 3103.5.1.3 Flood loads. An Emergency Action Plan, in accordance with Section 3103.5.4, shall be required for *public-occupancy temporary structures* in a Flood Hazard Area. Where an Emergency Action Plan is approved ~~by the building and fire official~~, *public occupancy temporary structures* need not be designed for flood loads specified in Section1612.

~~3103.5.1.6~~ 3103.5.1.4 Seismic loads. ~~Seismic design of *public-occupancy temporary structures* assigned to Seismic Design Categories C through F shall be determined in accordance with Section 1613. The resulting seismic~~ Seismic loads on *public-occupancy temporary structures* assigned to Seismic Design Categories C through F shall be ~~are~~ permitted to be taken as 75% of those determined by Section 1613. *Public-occupancy temporary structures* assigned to Seismic Design Categories A and B need not be designed for seismic loads.

~~3103.5.1.7~~ 3103.5.1.5 Ice loads. Ice loads on *public-occupancy temporary structures* shall be permitted to be determined ~~in accordance with Section 1614~~ with the largest maximum nominal thickness being 0.5 ~~in~~ inches (13 mm), for all Risk Categories**.** ~~If~~ Where the *public-occupancy temporary structure* is not subject to ice loads or not constructed and occupied during ~~winter months~~ times when ice is to be expected, ice loads need not be considered, provided that the design is reviewed and modified, as appropriate, to account for ice loads if the period of time when the temporary structure is in service shifts to include ~~winter months~~ times when ice is to be expected.

~~3103.5.1.8~~ 3103.5.1.6 Tsunami loads. An Emergency Action Plan, in accordance with Section 3103.5.4, shall be submitted for *public-occupancy temporary structures* in a Tsunami Design Zone ~~when requested by the Building or Fire Official~~. The *public-occupancy temporary structure* need not be designed for tsunami loads specified in Section 1615.

3103.5.2 Foundations. *Public-occupancy temporary structures* ~~may~~ shall be permitted to be supported on the ground with temporary foundations ~~when~~ where approved by the Building Official. Consideration shall be given for the impacts of differential settlement ~~when~~ where foundations do not extend below the ground or foundations supported on compressible materials. The presumptive load-bearing value for *public-occupancy temporary structures* supported on a pavement, slab on grade or on other *Collapsible or Controlled Low Strength* substrates soils such as beach sand or grass shall be assumed not to exceed 1,000 psf unless determined through testing and evaluation by a registered design professional. The presumptive load-bearing values listed in Table 1806.2 shall be permitted to be used for other supporting soil conditions.

3103.5.3 Installation and maintenance inspections. A qualified person shall inspect *public-occupancy temporary structures* that are assembled using transportable and reusable materials; components shall be inspected when purchased or acquired and at least once per year. The inspection shall evaluate individual components, and the fully assembled structure, to determine suitability for use based on the requirements in ESTA ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the *Building Official*. Additionally, *public-occupancy temporary structures* shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.

3103.5.5 Durability ~~and maintenance~~. Reusable components used in the erection and the installation of *public-occupancy temporary structures* shall be manufactured of durable materials necessary to withstand environmental conditions at the service location. Components damaged during transportation or installation and due to the effects of weathering shall be replaced or repaired.
~~A qualified person shall inspect *public-occupancy temporary structures*, including components, when purchased or acquired and at least once per year, based on the requirements in ANSI E1.21. Inspection records shall be kept and shall be made available for verification by the *building official*. Additionally, *public-occupancy temporary structures* shall be inspected at regular intervals when in service to ensure that the structure continues to perform as designed and initially erected.~~

CHAPTER 16
STRUCTURAL DESIGN

1608.1 General. Design snow *loads* shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof *load* shall be not less than that determined by Section 1607.

Exception: *Temporary structures* complying with Section ~~3103.5.1.3~~ 3103.5.1.1.

1609.1.1 Determination of wind loads. Wind *loads* on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design *wind speed*, *V*, and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.
7. *Temporary structures* complying with Section ~~3103.5.1.4~~ 3103.5.1.2.

The wind speeds in Figures 1609.3(1) through 1609.3(12) are basic design wind speeds, *V*, and shall be converted in accordance with Section 1609.3.1 to allowable stress design wind speeds, V_{asd}, when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

Exception: *Temporary structures* complying with Section ~~3103.5.1.5~~ 3103.5.1.3.

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category* A, B or C, or located where the mapped short-period spectral response acceleration, S_S, is less than 0.4 g.
2. The *seismic force-resisting system* of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. *Temporary structures* complying with Section ~~3103.5.1.6~~ 3103.5.1.4.

1614.1 General. *Ice-sensitive structures* shall be designed for atmospheric ice *loads* in accordance with Chapter 10 of ASCE 7. *Public-occupancy temporary structures* shall comply with Section 3103.7.3.

Exception: *Temporary structures* complying with Section ~~3103.5.1.7~~ 3103.5.1.5.

1615.1 General. The design and construction of *Risk Category* III and IV buildings and structures located in the *Tsunami Design Zones* defined in the *Tsunami Design Geodatabase* shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

Exception: *Temporary structures* complying with Section ~~3103.5.1.8~~ 3103.5.1.6.

Commenter's Reason: This public comment is being submitted to clarify the original proposal by making editorial changes, some minor changes that are technically substantive, and several clearly substantive changes. We believe this will result in a more reasonable, understandable, and enforceable code.
The substantive changes:

- Modify the definition of "public-occupancy temporary structure."

- As proposed, this definition is overly-broad. A building or structure that "provide[s] human shelter, protection, or safety" makes <u>any</u> building fall under this definition. Second, the use of "support" in the definition can cause confusion whether this is intended to mean structural support, or just be associated with the assemblies. Third, including "private assemblies" is confusing when the defined term is "public." Lastly, the second sentence in the definition is an exception to a code requirement that does not belong in a definition.
- This public comment addresses the issues above by changing "supports" to "serves," changes "public and private assemblies" to "assembly occupancies," moves the second sentence to an exception to the scoping of Section 3103.1, and replaces the reference to shelter/protection/safety with "public use."
  - "Serves" still brings the ancillary structures associated with temporary assemblies into these regulations, but doesn't confuse the issue of whether the structure needs to provide actual structural support for a stage, for example, in order for these regulations to apply.
  - The term "public use" was chosen to give the building official the flexibility to interpret it as needed, but to convey the idea the "public" had to be using the structure. Thus, the intent is to include structures like temporary COVID vaccination and testing facilities, field hospitals, or emergency shelter for people experiencing homelessness (e.g., "tiny home" villages), but not include temporary structures, for example, that only provide shelter for materials like cement bags or highway salt/sand.

- Delete the requirements related to Risk Category (Section 3103.5.1).
  - The main reason for the deletion is that the original proposal made some substantive modifications to the Risk Category table (1604.5) that we do not think were appropriate. First, it would have required a computerized timed egress analysis to prove these structures could be evacuated in 15 seconds, or else it would get thrown into Risk Category III. Second, it would require those temporary structures serving any assembly occupancy (speaker stands, light standards, etc.) to be classified as Risk Category III, which could be a more stringent classification than if they were permanent.
  - Ultimately, we think Risk Category should just be determined by Section 1604.5, and not modified here.

- Delete the Risk Category II limitation for reducing the snow loads (Section 3103.5.1.1, Exception).
  - The deletion creates consistency with use of the reduction factors for the wind and ice loads where controlled occupancy procedures are being used.
  - In addition, if controlled occupancy procedures are implemented (for example, evacuating the public-occupancy temporary structure), there is no reason why the same reduction factors could not be applied to structures in a higher risk category.

- Change references to "winter months" in the snow and ice sections to be more generic (Sections 3103.5.1.1 and 3103.5.1.5)
  - As we were collaborating with others on this, it was pointed out that some areas of the country have snow and ice events at times other than the winter months--in some cases, year-round. This public comment changes those references to refer to times when snow or ice "is to be expected," to allow for those regional differences.

- Require an Emergency Action Plan whenever a public-occupancy temporary structure is located in a tsunami design zone (Section 3103.5.1.6).
  - The original proposal made this only a requirement when the building or fire official asked for one. We believe that you should have should have an evacuation plan, along with triggers for initiating the plan whenever these are located in areas subject to tsunami inundation, similar to the flood loads section. These should be included in the Emergency Action Plan.

The technically substantive changes:

- Modifies the exception to Section 3103.5 (moved from the deleted 3103.5.1.2 on live loads) to refer to "a" registered design professional, rather than "the" registered design profession. The latter implies a specific person, which gets into contractural arrangements that the building code should not be regulating.
- Make all the load reductions in Section 3103.5.1 optional ("shall be permitted to be"), instead of making them mandatory per the original proposal.
- Aligns the wind speed terminology in the renumbered Section 3103.5.1.2 (wind loads) with the terminology used in S9-22 (Approved as Submitted by the Structural Committee)

The editorial changes:

- Makes the new text in Section 3103.5.1 (structural loads) charging for the rest of the section, saying to comply with the structural loads in Chapter 16, unless the following subsections modify them. This allows deletion of the dead and live load subsections since they didn't modify Chapter 16, and allows deletion of any pointers to Chapter 16 sections in the remaining subsections.
- Align the language among the sections (use parallel construction),
- Use traditional code language ("where" instead of "if" or "when," and "shall be permitted" instead of "may")
- Modify references to the load reduction tables to reflect the correct table numbers.
- Deletes the unnecessary table title in the relocated exception to Section 3103.5, and rearranges the text of the exception so the registered design professional needs to "demonstrate" the lower loads are justified.
- Reorganize some of the provisions as follows:
  - The exception within the definition of "public-occupancy temporary structure" becomes a second exception to the scoping in Section

3103.1. (See the substantive change to the definition, above.)
  - With the deletion of the live loads section (see substantive change to 3103.5.1 above), the exception that used to be in the live loads section is moved to the general charging for structural requirements (Section 3103.5).
  - A redundant provision for maintenance inspections is deleted from Section 3103.5.5 (Durability) and the statement of purpose for the inspections that was in deleted language is now included to Section 3105.3 (installation and maintenance inspections).
- Modify the references in the Chapter 16 exceptions to reflect the new organization.

This public comment is one of a series of three being submitted by WABO TCD and ASCE to improve this proposal. This public comment is not intended to override any substantive or organizational changes being made by the other comments. For reference, we have developed a clean version of the proposal that incorporates all three public comments (see link below), showing how the final code language for the entire change should appear, should all three public comments be approved.

https://www.cdpaccess.com/public-comment/3147/27095/files/download/3599/S116-22%20Temp%20Structures%20-%20Combined%20SIU%205-6-12%20PCs%20%28clean%29.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The original cost impact statement says the cost of construction will decrease. The editorial changes, minor substantive changes, and the change to the definition are clarifications that will have no effect on the original cost impact statement. The elimination of a requirement for a timed-egress analysis to avoid Risk Category III will reduce the cost of construction as compared to the original proposal, but overall, will have no effect on the original cost impact statement.

Public Comment# 3147

S122-22

IBC: 1609.6 (New), 1612.2, 1613.4 (New), 3001.3, 3001.6 (New)

Proposed Change as Submitted

Proponents: Julie Furr, representing FEMA-ATC Seismic Code Support Committee (jfurr@rimkus.com); Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov); Emily Guglielmo, representing NCSEA Wind Committee (eguglielmo@martinmartin.com); Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org); Robert Bachman, representing FEMA/ATC Seismic Code Support Committee (rebachmanse@aol.com)

2021 International Building Code

Add new text as follows:

1609.6 Elevators, Escalators, and other Conveying Systems. Elevators, escalators, and other conveying systems and their components exposed to outdoor environments shall satisfy the wind design requirements of ASCE 7.

Revise as follows:

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24. Elevators, escalators, conveying systems and their components shall conform to ASCE 24 and ASME A17.1/CSA B44 as applicable.

Add new text as follows:

1613.4 Elevators, Escalators, and other Conveying Systems. Elevators, escalators, and other conveying systems and their components shall satisfy the seismic requirements of ASCE 7 and ASME A17.1/CSA B44 as applicable.

Revise as follows:

3001.3 Referenced standards. ~~Except as otherwise provided for in this code, t~~ The design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to the applicable standard specified in Table 3001.3 and Section 3001.6. ~~ASCE 24 for construction in *flood hazard areas* established in Section 1612.3.~~

Add new text as follows:

3001.6 Structural Design. All interior and exterior elevators, escalators, and other conveying systems and their components shall comply with all applicable design loading criteria in Chapter 16, including wind, flood, and seismic loads established in Sections 1609, 1612, and 1613.

Reason: The proposed revisions to Chapter 30 are intended to clarify which design criteria and standards apply to elevators, escalators, conveying systems and their components and that the provisions are applicable to both interior and exterior systems. Additionally, since applicable standards are published by different organizations subject to different update cycles, this specifies that the provisions of all applicable standards shall apply to ensure the absence of a provision in one standard is not used to avoid the provision entirely. These revisions do not impose new technical requirements on the structural design of these systems.

Environmental provisions, both interior and exterior, are relevant to the design and construction of elevators, escalators, and conveying systems. However, Section 3001.3 currently points only to ASME, ALI, ANSI and ASCE 24 (flood provisions) standards, without reference to ASCE 7. The omission of ASCE 7 leaves Chapter 30 open to an interpretation that ASCE 7 does not apply or is overridden by the listed standards.

Wind

There have been many cases in south Florida where high wind loads were not considered in the design and installation of outdoors escalators and elevators. ASME A17.1 does not currently address wind provisions, leaving ASCE 7 as the next appropriate standard to reference. However, since ASCE 7 is not specified in Chapter 30, a common interpretation is that only ASME A17.1 should apply and ASCE 7 is not required. This leaves exterior structures vulnerable to damage and/or failure when exposed to high winds.

Seismic

ASME A17.1 and ASCE 7 both outline seismic requirements for elevators and conveying systems, but different update cycles mean these two standards are not always in sync. As such, seismic provisions in the current version of ASME A17.1 are based on ASCE 7-16 and still need to be updated to comply with changes in ASCE 7-22. There are significant differences in the requirements of ASCE 7-22 and ASCE 7-16 that the casual user may be unaware of. It is unknown if ASME A17.1 will be updated in time for incorporation into the 2024 IBC.

For individual structures, this proposal may reduce the nonstructural component seismic design forces constructed using lateral force-resisting system with higher ductility, which are commonly used in regions of high seismic risk while for structures using low or moderate ductility systems the seismic design forces may increase.

Flood

Reference to ASCE 24 specifically for elevators, escalators and conveying systems has been relocated to Section 1612. ASME A17.1 Section 8.12 specifically states that elevators must be in compliance with ASCE 24.

Other

Snow, ice, and other environmental loads are equally important to maintain structural stability and should be considered in design for exterior systems, where applicable. The general reference to Chapter 16 captures all other environmental loading conditions.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a clarification that more clearly defines when ASCE and ASME standards are required for different environmental loads and conditions. The added language in Chapter 16 further clarifies that a lack of reference to specific environmental loads in one standard does not mean the design is exempt from considering that environmental load.

S122-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal appropriately addresses the load requirements for elevators, escalators and other conveying systems. (Vote:14-0)

S122-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1612.2

Proponents: Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24. Elevators~~, escalators, conveying systems~~ and their components shall conform to ASCE 24 and ASME A17.1/CSA B44 as applicable.

Commenter's Reason: ASCE 24 and ASME A17.1/CSA B44 do not currently contain flood requirements for escalators and other conveying systems (only elevators); therefore, including them here could result in confusion. Recommend the proposed further revision for clarification.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment proposal is for clarification only and therefore will not increase or decrease the cost of construction.

Public Comment# 3088

S133-22

IBC: 1613.4 (New), ASCE/SEI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Kelly Cobeen, representing Federal Emergency Management Agency/Applied Technology Council - Seismic Code Support Committee (kcobeen@wje.com); Michael Mahoney, representing FEMA (mike.mahoney@fema.dhs.gov); Robert Bachman, representing FEMA/ATC Seismic Code Support Committee (rebachmanse@aol.com)

2021 International Building Code

Add new text as follows:

1613.4 NFPA 13 sprinkler systems. NFPA 13 sprinkler systems, including their anchorage and bracing, shall comply with the seismic design force requirements of ASCE 7 Section 13.3.1.

Add new standard(s) as follows:

ASCE/SEI

American Society of Civil Engineers Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191

7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Reason: The seismic design force equations for nonstructural components provided in Chapter 13 of ASCE/SEI 7-22 have significantly changed since the ASCE 7-16 edition. Sprinkler systems are considered nonstructural components. The current version of NFPA 13 is based on ASCE 7-16 and does not satisfy the ASCE 7-22 seismic requirements and significant changes are required to bring them into compliance. NFPA has been advised that significant changes are needed and it is their intent to attempt to include in their next version scheduled for publication in 2022 or to publish a Tentative Interim Amendment (TIA) after the next edition is published. In the meantime, this proposed language will alert the user and the authority having jurisdiction that the seismic design requirements of ASCE 7-22 must also be satisfied in addition to those of NFPA 13. Hopefully by the time the 2024 IBC will be enforced, the next edition will have been updated to include the needed revisions to comply with ASCE 7-22 or a TIA will have been published so that the user and authority having jurisdiction will have a version of NFPA 13 which will satisfy ASCE 7-22 seismic design requirements.
The proposed change is only required if the edition of ASCE 7 is updated from ASCE 7-16 to ASCE 7-22, as per other code change proposals. Should the update to ASCE 7-22 not be adopted, it is recommended that this code change be disapproved.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not, in general, increase or decrease the overall cost of construction. However, for individual structures, this proposal may reduce the nonstructural component seismic design forces constructed using lateral force-resisting system with higher ductility, which are commonly used regions of high seismic risk while for structures using low or moderate ductility systems the seismic design forces may increase.

Staff Analysis: The proposal is referencing an updated version of an existing referenced standard. Therefore, the updated version is considered an new standard. A review of the standard proposed for inclusion in the code, ASCE/SEI 7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S133-22

Public Hearing Results

This proposal includes published errata

https://cdn-www-v2.iccsafe.org/wp-content/uploads/2022-GROUP-B-CONSOLIDATED-MONOGRAPH-UPDATES-3-14-22.pdf

Committee Action: As Modified

Committee Modification:

1613.4 ~~NFPA 13~~ Automatic sprinkler systems. ~~NFPA 13~~ Where required, *automatic sprinkler system* ~~including their~~ anchorage and bracing, shall comply with ~~the seismic design force requirements of~~ ASCE 7 and Section 903.3.1.1. ~~Section 13.3.1.~~

Committee Reason: Approved as modified as the proposal clarifies the source for the design of anchorage and bracing for automatic sprinkler systems. The modification aptly removes the pointer to NFPA 13 and leaves the pointer to ASCE 7 to add clarification to the provision. (Vote: 14-0)

S133-22

Individual Consideration Agenda

Public Comment 1:

Proponents: Jeffrey Hugo, representing NFSA (hugo@nfsa.org) requests Disapprove

Commenter's Reason: The proponents and stakeholders formed a task group over the summer to develop seismic bracing criteria and a Tentative Interim Amendment (TIA) for the referenced edition of NFPA 13 to meet the new ASCE 7-2022. This public comment is a placeholder to discuss disapproval if necessary.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3299

S134-22

IBC: SECTION 1616 (New), 1616.1 (New)

Proposed Change as Submitted

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org)

2021 International Building Code

Add new text as follows:

SECTION 1616
FIRE LOADS

1616.1 General. Where the structural fire protection of structural elements is designed considering system-level behavior or realistic fire exposures, the design shall be in accordance with ASCE 7. Where the structural fire protection is designed per this section, all other provisions of Chapter 7 shall apply.

Reason: American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) has developed industry consensus on performance-based structural fire design within the ASCE/SEI 7 standard [1] as demonstrated in their freely-available ASCE/SEI Design Guide (Performance-Based Structural Fire Design: Exemplar Designs of Four Regionally Diverse Buildings using ASCE 7-16, Appendix E) [2]. For the first time in U.S. practice, this standard establishes the process that enables designers to upgrade structures (e.g., structural connections) to be intrinsically safer to fire effects (e.g., restrained thermal expansion/contraction and large deflections) in order to better protect building occupants and firefighters from structural collapse due to uncontrolled fire events. Also, ASCE/SEI 7 Appendix E works within the greater ASCE/SEI 7 context which is important to ensure that fire effects are analyzed in a similar fashion as other structural loads (e.g., wind and seismic). Notably, ASCE/SEI 7 Appendix E Section E.3 requires for a structural fire design to comply with the requirements of ASCE/SEI 7 Section 1.3.1.3, which details peer review requirements among other structural engineering aspects. Lastly, the standard is structured to formally integrate building officials into the design process in a similar manner as performance-based structural engineering is conducted for other design hazards (e.g., blast, seismic, and wind). In summary, this code change proposal adds the appropriate reference to the ASCE/SEI 7 standard for performance-based structural fire design. Importantly, ASCE/SEI 7 Appendix E Appendix E provides material-neutral and critical overarching requirements.
This proposal is submitted by the ICC Building Code Action Committee (BCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2020 and 2021 the BCAC has held several virtual meetings open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the BCAC website at https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/building-code-action-committee-bcac/.

https://www.cdpaccess.com/proposal/8203/24809/files/download/2858/
https://www.cdpaccess.com/proposal/8203/24809/files/download/2840/
https://www.cdpaccess.com/proposal/8203/24809/files/download/2839/

Bibliography: [1] ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Appendix E: Performance-Based Design Procedures for Fire Effects on Structures, American Society of Civil Engineers: Structural Engineering Institute, 2016
[2] ASCE/SEI Performance-Based Structural Fire Design: Exemplar Designs of Four Regionally Diverse Buildings using ASCE 7-16, Appendix E, American Society of Civil Engineers: Structural Engineering Institute and Charles Pankow Foundation, 2020 <
https://ascelibrary.org/doi/book/10.1061/9780784482698 >.

The following attachment (free/open source) per Reference [1] and [2]: https://eshare.element.com/url/3udcsdjqruhpdnqk

Also, the following link where the Design Guide can be freely viewed or downloaded (simply click "PDF"): Performance-Based Structural Fire Design | Books (ascelibrary.org)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed code change would have no direct impact on construction costs since alternative methods are already being conducted in practice and the performance-based structural fire design procedures in ASCE/SEI 7 represent current industry best practices.

S134-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as performance based design is already allowed in the code. The proposal needs to be reworded to add clarity. The title of the proposed Section 1616, 'fire loads', is the not the common term used. (Vote: 14-0)

S134-22

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 1617 (New), 1617.1 (New)

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org) requests As Modified by Public Comment

Replace as follows:

2021 International Building Code

SECTION 1617
FIRE-INDUCED EFFECTS

1617.1 General. . Primary structural frame and secondary structural members designed for fire-induced effects in accordance with ASCE/SEI 7 Section 1.3.1.3 are permitted as an alternative method to meet the fire-resistance requirements of those structural members.

Commenter's Reason: The main goal of this proposal and the PC is to permit the design of structures to a level of reliability for fire-induced effects which is consistent with other hazards such as wind and seismic.
This public comment is meant to address Group B committee code action hearing by:

1) The title has been revised to prevent a conflict with terminology used in NFPA 557.

2) The following undefined terms have been removed and replaced with proper terminology: “structural elements,” “structural fire protection,” “system-level behavior,” and “realistic fire exposures.” Notably, reference to “primary structural frame” and “secondary structural members” upholds the intent of IBC 707.5.1, and bearing walls are intentionally excluded from the scope of this proposal.

3) A reference to fundamental structural engineering requirements contained in ASCE/SEI 7 Section 1.3.1.3 has been added to permit methods other than that contained in ASCE/SEI 7 Appendix E, which also addresses comments pertaining to circular referencing.

4) It was suggested that this proposal belongs in the International Performance Code. However, this proposal aims to extend structural design provisions to fire-induced effects which belongs in IBC Chapter 16. This is consistent with other IBC provisions that are not prescriptive (e.g., structural design provisions, rational smoke control design provisions, firewall design provisions, and others). Notably, the IBC currently permits performance-based structural design in accordance with ASCE/SEI 7 for tsunami (ASCE/SEI 7 Sections 6.8.3.5.2.1 and 6.12.3), snow (ASCE/SEI 7 Section 7.14), seismic (ASCE/SEI 7 Section 12.2.1), wind (ASCE/SEI 7 Section 26.1.3) and tornado (ASCE/SEI 7 Section 32.1.3) directly via the applicable references in IBC Chapter 16 to ASCE/SEI 7 for the given load.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed code change would have no direct impact on construction costs structural design procedures in ASCE/SEI 7 represent current industry best practices, whether it pertains to wind, seismic, tsunami, or in this case, fire-induced effects.

Public Comment# 3097

S137-22

IBC: 1704.3, 1704.3.1

Proposed Change as Submitted

Proponents: Gregory Robinson, representing National Council of Structural Engineers Associations (grobinson@lbyd.com)

2021 International Building Code

1704.3 Statement of special inspections. Where *special inspections* or tests are required by Section 1705, the *registered design professional in responsible charge* shall prepare a statement of *special inspections* in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of *special inspections* is permitted to be prepared by a qualified person *approved* by the *building official* for construction not designed by a *registered design professional*.

Revise as follows:

1704.3.1 Content of statement of special inspections. The statement of *special inspections* shall identify the following:

1. The materials, systems, components and work required to have *special inspections* or tests by the *building official* or by the *registered design professional* responsible for each portion of the work.
2. The type and extent of each *special inspection*.
3. The type and extent of each test.
4. Additional requirements for *special inspections* or tests for seismic or wind resistance as specified in Sections 1705.12, 1705.13 and 1705.14 .
5. For each type of *special inspection*, identification as to whether it will be continuous *special inspection*, periodic *special inspection* or performed in accordance with the notation used in the referenced standard where the inspections are defined.
6. <u>Deferred submittal items that may require a supplemental statement of special inspections to be prepared.</u>

Reason: This proposal is complimentary to the proposed modifications to Section 107.3.4.1.1. The proposed language is intended to have the registered design professional in responsible charge, who is responsible for the overall preparation and submission of the statement of special inspections, to identify the deferred submittal items within the statement of special inspections that may require additional special inspections and tests, etc., so that the building official and owner know the associated special inspections and tests have not been provided, yet, but they may be expected as part of the deferred submittal. This proposal clarifies that some items have not been fully designed at the time of permit application. Item 1 of Section 1704.3.1 already indicates that the determination of which special inspections or tests are required for work related to deferred submittals by the design professional responsible for its design. The building official and owner, however, may not know that such work will have special inspections or tests that have not been identified in the statement of special inspections submitted at the time of application for permit. Substantial structural systems, components, and connections (e.g., precast concrete structural members and connections, as well as steel moment connections) are often deferred to the contractor to provide the most economical, locally-available solutions for the owner. If these special inspections or tests for work that is part of the deferred submittal are not provided by the registered professional responsible for its design, because they did not know they were responsible for it and thought the architect- or engineer-of-record would specify all special inspections and tests, it could jeopardize the life-safety of the building due to critical elements not undergoing special inspections or tests in accordance with the Code. Overall, this language clarifies that the work related to deferred submittals shall have special inspections or tests determined by the design professional responsible for its design.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase or decrease the cost of construction, although, by alerting the owner of forthcoming special inspections and tests that are in addition to those specified in the statement of special inspections submitted at time of application for permit, the associated costs are not unexpected. This proposal clarifies code intent. These changes are not expected to affect cost of construction.

S137-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the term 'may' is unenforceable. A public comment could improve the proposal. (Vote: 13-1)

S137-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1704.3.1

Proponents: Gwenyth Searer, representing myself (gsearer@wje.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1704.3.1 Content of statement of special inspections. The statement of *special inspections* shall identify the following:

1. The materials, systems, components and work required to have *special inspections* or tests by the *building official* or by the *registered design professional* responsible for each portion of the work.
2. The type and extent of each *special inspection*.
3. The type and extent of each test.
4. Additional requirements for *special inspections* or tests for seismic or wind resistance as specified in Sections 1705.12, 1705.13 and 1705.14 .
5. For each type of *special inspection*, identification as to whether it will be continuous *special inspection*, periodic *special inspection* or performed in accordance with the notation used in the referenced standard where the inspections are defined.
6. Deferred submittal items that ~~may~~ require a supplemental statement of special inspections ~~to be prepared~~.

Commenter's Reason: During the Committee Action Hearing, the Committee did not like the use of the word "may" in the proposal because they felt it indicated non-mandatory language. At least two Committee members indicated that they would also prefer to strike the words "to be prepared" as unnecessary language. The Committee indicated that they would like this proposal brought back in the public comment period with these two changes.
The proposal is a good one, and requires that the Statement of Special Inspections must list deferred submittal items that require a supplemental statement of special inspections. This will help avoid "dropped balls" between the engineer-of-record, the building official, and any engineers responsible for the design of the deferred submittals.

For these reasons, I ask that the Assembly approve this proposal as modified by public comment. Thank you.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The original proposal had no significant costs associated with it, and this public comment does not change the intent, the implementation, or the cost of the proposal in any way.

Public Comment# 3502

S140-22

IBC: 1705.1, 1705.1.1, 1705.1.2 (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Building Code

1705.1 General. *Special inspections* and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705.1.1 Special cases. *Special inspections* and tests shall be required for proposed work that is, in the opinion of the *building official*, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

Add new text as follows:

1705.1.2 Ground-mounted photovoltaic (PV) panel systems. *Special inspections* and tests shall not be required for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings. The *building official* shall be permitted to modify or exempt *special inspection* requirements for *deep foundation* elements for *ground-mounted PV panel systems.*

Reason: A requirement for continuous Special Inspection for foundations for photovoltaic panel systems is overly restrictive.
For smaller installations -- such as residential ground-mounted photovoltaic panel systems -- continuous special inspection beyond the AHJ/County inspection adds project cost disproportionate to the risk to the project. Most AHJ/County Building Officials have agreed that special inspection is not necessary or reasonable for these small systems.

The first statement in proposed Section 1705.1.2 seeks to formalize the exemption that is commonly applied to small systems.

Large-scale (often called "utility scale") photovoltaic power plants often have tens of thousands of small piles. As project financing often involves third-party investors, existing measures of quality control are already in place. The developer and/or EPC (Engineer, Procure, Construct) contractor often use a rigorous design and testing process to optimize pile specifications, as part of value engineering. As part of their risk-management process, project financiers often use third-party Independent Engineers (IE's) to ensure quality controls are in place. Under current practice, it is extremely uncommon for local Building Officials to require Special Inspection for "deep" foundations for photovoltaic panel systems, regardless of the absence of an exception for these systems.

Large-scale photovoltaic power plants usually incorporate rigorous design and quality control steps, as follows:

1. Foundation elements designed by analysis, based on geotechnical investigation.

2. As thousands of small piles are used in a photovoltaic pow er plant, optimization of design usually includes preconstruction pile load testing conducted on site. Independent Engineers (IE's) often review test reports.

3. EPC contractor has their ow n internal quality control.

4. A representative sample of production piles (for example, 1 percent) are usually proof-tested during construction, to ensure adequate pile capacities are being achieved. Adjustments are made if necessary to meet the demand.

5. County/AHJ inspectors usually conduct periodic observation of pile installation. For large-scale power plants, these inspectors are often third-party inspectors.

6. IE's usually conduct site visits to observe installation methods and review inspection reports and production pile load test reports. A final report is prepared by the IE.

Owing to this rigorous program of quality control, continuous special inspection of "deep" foundations is highly redundant. A Special Inspector could be required to be on-site for one to three months watching piles being installed, even though the same piles are already being observed and monitored by the Developer, the EPC Contractor, the AHJ/County inspector, and the Independent Engineer.

The second statement in proposed Section 1705.1.2 seeks to allow the Building Official the flexibility allow modifications or exemptions to special inspection requirements, without taking away any such authority. For example, a Building Official could decide that an agreed-upon frequency of periodic special inspection, or might be satisfied with quality controls in place on behalf of the owner or EPC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. In some cases, this proposal could decrease the cost of construction, where continuous special inspection is no longer a stated requirement for ground-mounted photovoltaic panel systems.

S140-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as this issue is already addressed in section 1704. The phrase 'serving' Group R3 is unclear. (Vote: 14-0)

S140-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1705.1, 1705.1.1, 1705.1.2

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1705.1 General. *Special inspections* and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705.1.1 Special cases. *Special inspections* and tests shall be required for proposed work that is, in the opinion of the *building official*, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.
3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705.1.2 Ground-mounted photovoltaic (PV) panel systems. ~~*Special inspections* and tests shall not be required for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.~~ The *building official* shall be permitted to modify or exempt *special inspection* requirements for *deep foundation* elements for *ground-mounted PV panel systems.*

Commenter's Reason: The original proposal sought to exempt PV panel systems serving Group R-3 buildings from Special Inspection requirements for deep foundations. Although we were not expecting any opposition on this one point, some testifiers felt this is "tying the hands" of the building official. This public comment completely strikes out the requested exemption for Group R-3, and instead relies on the existing Exception 1 to Section 1704.2 that states: "Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official."
The second sentence of the original proposal remains, as it provides flexibility to the building official without taking anything away. The existing language in Tables 1705.7 and 1705.8 and Section 1705.9 is interpreted by a very small minority of building departments as "tying the hands" of the building official. Continuous special inspection is not practical and has no added value when tens of thousands of very small individual deep foundation elements are used for large-scale PV facilities.

This proposal and this public comment seek to provide flexibility for the building official to make their own judgment call regarding modifying the requirement to periodic special inspections, or to provide an exemption from special inspection for small projects, depending on the type of foundation proposed, the construction techniques, and the site conditions.

For additional information regarding Special Inspections for PV facility foundations, we refer the reader to our original Reason Statement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and the public comment seek to formalize the Special Inspection criteria that is the most common across the U.S. For the vast majority of AHJs, the net effect of the public comment and code change proposal will not increase or decrease the cost of construction. However, for those AHJs who presently feel they have no choice and no flexibility to modify Special Inspection criteria, the net effect could be to decrease the cost of construction.

Public Comment# 3454

S143-22

IBC: TABLE 1705.3

Proposed Change as Submitted

Proponents: Stephen Skalko, representing Precast/Prestressed Concrete Institute (svskalko@svskalko-pe.com); Edith Smith, representing Precast/Presresssed Concrete Institiute (esmith@pci.org)

2021 International Building Code

Revise as follows:

TABLE 1705.3 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

Portions of table not shown remain unchanged.

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	IBC REFERENCE
2. Reinforcing bar welding:			AWS D1.4 ACI 318: ~~26.6.4~~ 26.13.3	—
a. Verify weldability of reinforcing bars other than ASTM A706;	-	X		
b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls, and coupling beams.	X	-		
c. Inspect welded reinforcement splices; and	X	-		
~~b~~ d. Inspect single-pass fillet welds, maximum $^{5}/_{16}''$; and	-	X		
~~c.~~ e Inspect all other welds.	~~X~~ -	X		

For SI: 1 inch = 25.4 mm.

Reason: This proposed change coordinates the special inspection provisions for welding of reinforcing steel in the IBC with the provisions in Section 26.13.3 of ACI 318. New Item 2(b) adds the requirement for continuous inspection of welding of reinforcement in special moment frames, boundary elements of special structural walls, and coupling beams as required by ACI 318 Section 26.13.2(d). Because of the critical nature of welded reinforcement splices, new Item 2(c) is added to require continuous special inspection of all welded reinforcement splices.
Existing Item 2(b) for periodic inspection of single pass fillet welds is renumbered as Item (d). And existing Item 2(c) for special inspection of all other welds is renumbered as Item 2(e) and revised to permit these welds to be performed as a periodic special inspection since the critical welds covered by new Items 2(b) and 2(c) have been re-introduced introduced into the table.

A review of the 2012 or any earlier edition of the IBC would show that the inspection requirements were essentially the same as what is now proposed (and as they are also in ACI 318-19). The requirements have been in their current form since the 2015 IBC, as the result of Code Change S148-12. That code change was said to be organizational; yet it turned out to be a very substantive change. This proposed change corrects the inconsistency.

Cost Impact: The code change proposal will decrease the cost of construction
The cost of precast concrete construction, where welding of reinforcing bars is not uncommon, should decrease modestly through the elimination of unnecessary continuous special inspection in many cases.

S143-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

TABLE 1705.3 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	IBC REFERENCE
2. Reinforcing bar welding:				—
a. Verify weldability of reinforcing bars other than ASTM A706;	-	X	*(a)* AWS D1.4 ACI 318: ~~26.13.3~~ 26.13.1.4	
b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls, and coupling beams.	X	-	*(b)* AWS D1.4 ACI 318: 26.13.3	
c. Inspect welded reinforcement splices	X	-	*(c)* —	
d. Inspect welding of primary tension reinforcement in corbels	X	-	*(d)* —	
e.~~d.~~ Inspect single-pass fillet welds, maximum $^{5}/_{16}''$; and	-	X	*(e)* AWS D1.4 ACI 318: 26.13.3	
f.~~e.~~ Inspect all other welds.	-	X	*(f)* AWS D1.4 ACI 318: 26.13.3	

For SI: 1 inch = 25.4 mm.

Committee Reason: Approved as modified as per the 1st paragraph of the provided reason statement. The modification provides required specific references in Table 1705.3 and adds the inspection requirements for welding of primary tension reinforcement in corbels as supported by industry. (Vote: 14-0)

S143-22

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 1705.3

Proponents: Stephen Kerr, representing Structural Engineers Association of California (SEAOC) General Requirements Committee (skerr@jwa-se.com); Roy Lobo, representing SEAOC (loboroy@frontiernet.net) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

TABLE 1705.3 REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD[a]	IBC REFERENCE
2. Reinforcing bar welding:				
a. Verify weldability of reinforcing bars other than ASTM A706;	-	X	AWS D1.4 ACI 318: 26.13.1.4	
b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls, and coupling beams	X	-	AWS D1.4 ACI 318: 26.13.3	
c. Inspect welded reinforcement splices	X	-	-	
d. Inspect welding of primary tension reinforcement in corbels	X	-	-	—
e. Inspect single-pass fillet welds, maximum $^5/_{16}''$; and	-	X	AWS D1.4 ACI 318: 26.13.3	
f. Inspect all other welds.	~~-~~X	~~X~~ -	AWS D1.4 ACI 318: 26.13.3	

For SI: 1 inch = 25.4 mm.

Commenter's Reason: The proposed modification is intended to preserve the "all other welds" as continuous. The proponent of S143 is correct that back in 2012 the change did modify the inspection requirements shifting the other welds to continuous. However, the change S148-12 was clear that the modifications in the change were not just organizational.
The original reason statement from S148-12:

"... The purpose for this proposal is to simplify the required extent (continuous or periodic) of special inspection for the welding of reinforcing bars, which is currently based on the structural design (e.g., resisting flexural, axial or shear forces). The proposal changes the extent to continuous special inspection of all welding of reinforcing bars except for single-pass fillet welds that are a maximum of 5/16-inch where periodic special inspection is permitted. This will also be consistent with the historical approach taken by the building code for the extent of special inspections related to welding."

The change to limit the periodic welding was clearly spelled out in the S148-12 change. This has been argued in subsequent code cycles with proposals S136-16 and S96-19. The code has still maintained that "all other welds" as continuously inspected. If item f "all other welds" are considered to be periodically inspected, then there is a conflict with item e for fillet welds a maximum of 5/16". Larger multi-pass fillet welds do not fall under items a - e, therefore would be considered an "all other weld" and would be periodically inspected. The larger multi-pass welds should continue to be continuously inspected.

There are some additional welds that could reasonably be periodically inspected, rather than continuous. However these welds should be clearly spelled out, similar to the item e 5/16" fillet welds.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The effect of the proposed public comment will maintain the current practice for reinforcement special inspection, and thus not change the cost of construction. The proposed public comment will require more continuous inspections (added cost) above and beyond the proposal as currently written.

Public Comment# 3416

S144-22

IBC: 1705.4, SECTION 2109

Proposed Change as Submitted

Proponents: Jason Thompson, representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

The primary section number and title shown as deleted (2109) includes the deletion of all sections and subsections within it. For clarity, the full text of these deletions is not shown.

2021 International Building Code

Revise as follows:

1705.4 Masonry construction. *Special inspections* and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

Exception: *Special inspections* and tests shall not be required for:

1. Glass unit masonry or masonry veneer designed in accordance with Section 2110 or Chapter 14, ~~Empirically designed masonry, *glass unit masonry* or masonry *veneer* designed in accordance with Section 2109, Section 2110 or Chapter 14,~~ respectively, where they are part of a structure classified as *Risk Category* I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

Delete without substitution:

~~SECTION 2109~~
~~EMPIRICAL DESIGN OF ADOBE MASONRY~~

Reason: The option for empirically designed masonry has been removed from the 2022 edition of TMS 402. As such, references to these provisions from the IBC are also being deleted - including all of Section 2109 of the IBC. Of note, the scope of Section 2109 is limited to empirically designed adobe masonry construction. Although there is a reference to the empirical design provisions of TMS 402 in Section 2109, there are questions as to whether the use of the empirical design provisions of TMS 402, which were developed for clay and concrete masonry construction, are appropriate and applicable to adobe masonry construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal simply deletes a historical design method that is no longer included in the referenced standard.

S144-22

Public Hearing Results

This proposal includes published errata

https://cdn-www-v2.iccsafe.org/wp-content/uploads/2022-GROUP-B-CONSOLIDATED-MONOGRAPH-UPDATES-3-14-22.pdf

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal deletes a design method that is no longer in the referenced standard. (Vote: 14-0)

S144-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1705.4, SECTION 2109, 2109.1, 2109.1.1, 2109.2

Proponents: Ben Loescher, representing The Earthbuilders' Guild (bloescher@lmarchitectsinc.com); David Eisenberg, representing DCAT (strawnet@gmail.com); Anthony Dente, representing Verdant Structural Engineers (anthony@verdantstructural.com); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net) requests As Modified by Public Comment

Replace as follows:

2021 International Building Code

1705.4 Masonry construction. *Special inspections* and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

Exception: *Special inspections* and tests shall not be required for:

1. Glass unit masonry or masonry veneer designed in accordance with Section 2110 or Chapter 14, ~~Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, Section 2110 or Chapter 14,~~ respectively, where they are part of a structure classified as Risk Category I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

SECTION 2109
EMPIRICAL DESIGN OF ADOBE MASONRY

2109.1 General. Empirically designed adobe masonry shall conform to the requirements of Appendix A of TMS 402-16, except where otherwise noted in this section.

2109.1.1 Limitations. The use of empirical design of adobe masonry shall be limited as noted in Section A.1.2 of TMS 402-16. In buildings that exceed one or more of the limitations of Section A.1.2 of TMS 402 -16, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2 or the foundation wall provisions of Section 1807.1.5.
Section A.1.2.2 of TMS 402-16 shall be modified as follows:

> A.1.2.2 – *Wind*. Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where V_{asd} as determined in accordance with Section 1609.3.1 of the *International Building Code* exceeds 110 mph.

2109.2 Adobe construction. *Adobe construction* shall comply with this section and shall be subject to the requirements of this code for Type V construction, Appendix A of TMS 402 -16, and this section.

Commenter's Reason: Summary:
The intent of proposal S144-22, approved in the Committee Action Hearings was to remove the reference in the IBC, to the soon-to-be-retired Appendix A of TMS 402. However this action has the consequence of deleting all language in the IBC pertaining to adobe construction, which will be devastating to a relatively small but significant regional industry for both contemporary and historical adobe structures. This includes material suppliers, design and building professionals and owners and occupants of adobe masonry structures. This Public Comment achieves the goals of the original proposal's authors while preserving the critical provisions of Section 2109 Empirical Design of Adobe Masonry, to regulate the structural design and material requirements of adobe masonry, which would otherwise become unregulated.

Empirical Design:

The adobe section of the IBC has successfully relied upon the empirical design provisions of TMS 402 without controversy since the IBC's first edition in the year 2000. In recent years TMS 402's authors have decided to no longer use empirical design for contemporary masonry materials, construction methods and building types, because these modern buildings and materials no longer rely on the smaller quantity and size of openings, more frequent cross walls, and shorter walls assumed in Appendix A. These points do not apply to adobe construction whose utilization consists of small, one- or two-story buildings with small openings, cross walls, and conservative height/thickness ratios.

Additionally, adobe is a material for which there is greater variability in mortar and masonry unit qualities than modern masonry products. As a result, cost-effective adobe construction depends upon time-tested and appropriately conservative empirical methods to guide design for the smaller scale projects it is used for, that cannot justify the expense of laboratory testing for each source and product.

TMS 402 Appendix A:

While Appendix A will no longer be included in future editions of TMS 402, retaining reference to the current edition (TMS 402- 16) will allow adobe to remain in the IBC until a standard specific to adobe construction can be created and approved as a referenced standard in the IBC. The proponents of this Public Comment have conferred with The Masonry Society (the propagator of TMS 402), who have confirmed that TMS 402-16 will remain available for the foreseeable future.

Windspeed:

A related Public Comment on Proposal S185-22 proposes to correct a typographical error in 2109.1.1.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction. By avoiding the deletion of code provisions for adobe construction, this Public Comment will provide contractors and consumers the ability to use a building material which is cost-effective in the regions that it is used, and particularly beneficial to owner-builders and projects in rural areas.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
By avoiding the deletion of code provisions for adobe construction, this Public Comment will provide contractors and consumers the ability to use a building material which is cost-effective in the regions that it is used, and particularly beneficial to owner-builders and projects in rural areas.

Public Comment# 3181

Public Comment 2:

Proponents: CP28 administration

Commenter's Reason: The administration of ICC Council Policy 28 (CP28) is not taking a position on this code change. This public comment is being submitted to bring a procedural requirement to the attention of the ICC voting membership. In accordance with Section 3.6.3.1.1 of ICC Council Policy 28 (partially reproduced below), the new referenced standard TMS 402-22 must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.
(CP28) 3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
N/A

Public Comment# 3536

S145-22

IBC: 1705.7, 1705.8, 1705.9

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2021 International Building Code

Revise as follows:

1705.7 Driven deep foundations. *Special inspections* and tests shall be performed during installation of driven *deep foundation* elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the *registered design professionals* shall be used to determine compliance.

Exceptions:

1. Driven *deep foundations* for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.
2. The *building official* shall be permitted to modify or exempt *special inspection* requirements for driven *deep foundations* for *ground-mounted photovoltaic panel systems.*

1705.8 Cast-in-place deep foundations. *Special inspections* and tests shall be performed during installation of cast-in-place *deep foundation* elements as specified in Table 1705.8. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professionals* shall be used to determine compliance.

Exceptions:

1. Cast-in-place *deep foundations* for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.
2. The *building official* shall be permitted to modify or exempt *special inspection* requirements for cast-in-place *deep foundations* for *ground-mounted photovoltaic panel systems.*

1705.9 Helical pile foundations. *Continuous special inspections* shall be performed during installation of *helical pile* foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the *registered design professional* in responsible charge. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professional* shall be used to determine compliance.

Exceptions:

1. *Helical pile* foundations for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.
2. The *building official* shall be permitted to modify or exempt *special inspection* requirements for *helical pile foundations* for *ground-mounted photovoltaic panel systems.*

Reason: A requirement for continuous Special Inspection for foundations for photovoltaic panel systems is overly restrictive.
For smaller installations -- such as residential ground-mounted photovoltaic panel systems -- continuous special inspection beyond the AHJ/County inspection adds project cost disproportionate to the risk to the project. Most AHJ/County Building Officials have agreed that special inspection is not necessary or reasonable for these small systems.

Proposed Exception 1 seeks to formalize the exemption that is commonly applied to small systems.

Large-scale (often called "utility scale") photovoltaic power plants often have tens of thousands of small piles. As project financing often involves third-party investors, existing measures of quality control are already in place. The developer and/or EPC (Engineer, Procure, Construct) contractor often use a rigorous design and testing process to optimize pile specifications, as part of value engineering. As part of their risk-management process, project financiers often use third-party Independent Engineers (IE's) to ensure quality controls are in place. Under current practice, it is extremely uncommon for local Building Officials to require Special Inspection for "deep" foundations for photovoltaic panel systems, regardless of the absence of an exception for these systems.

Large-scale photovoltaic power plants usually incorporate rigorous design and quality control steps, as follows:

1. Foundation elements designed by analysis, based on geotechnical investigation.

2. As thousands of small piles are used in a photovoltaic pow er plant, optimization of design usually includes preconstruction pile load testing

conducted on site. Independent Engineers (IE's) often review test reports.

3. EPC contractor has their ow n internal quality control.

4. A representative sample of production piles (for example, 1 percent) are usually proof-tested during construction, to ensure adequate pile capacities are being achieved. Adjustments are made if necessary to meet the demand.

5. County/AHJ inspectors usually conduct periodic observation of pile installation. For large-scale power plants, these inspectors are often third-party inspectors.

6. IE's usually conduct site visits to observe installation methods and review inspection reports and production pile load test reports. A final report is prepared by the IE.

Owing to this rigorous program of quality control, continuous special inspection of "deep" foundations is highly redundant. A Special Inspector could be required to be on-site for one to three months watching piles being installed, even though the same piles are already being observed and monitored by the Developer, the EPC Contractor, the AHJ/County inspector, and the Independent Engineer.

Proposed Exception 2 seeks to allow the Building Official the flexibility allow modifications or exemptions to special inspection requirements, without taking away any such authority. For example, a Building Official could decide that an agreed-upon frequency of periodic special inspection, or might be satisfied with quality controls in place on behalf of the owner or EPC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. In some cases, this proposal could decrease the cost of construction, where continuous special inspection is no longer a stated requirement for ground-mounted photovoltaic panel systems.

S145-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved consistent with the committee action on S140-22. (Vote: 14-0)

S145-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1705.7, 1705.8, 1705.9

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (joecainpe@gmail.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1705.7 Driven deep foundations. *Special inspections* and tests shall be performed during installation of driven *deep foundation* elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the *registered design professionals* shall be used to determine compliance.

Exception ~~Exceptions~~:

~~1. Driven *deep foundations* for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.~~

~~2.~~ The *building official* shall be permitted to modify or exempt *special inspection* requirements for driven *deep foundations* for *ground-mounted photovoltaic panel systems*.

1705.8 Cast-in-place deep foundations. *Special inspections* and tests shall be performed during installation of cast-in-place *deep foundation* elements as specified in Table 1705.8. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professionals* shall be used to determine compliance.

Exception ~~Exceptions~~:

~~1. Cast-in-place *deep foundations* for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.~~

~~2.~~ The *building official* shall be permitted to modify or exempt *special inspection* requirements for cast-in-place *deep foundations* for *ground-mounted photovoltaic panel systems*.

1705.9 Helical pile foundations. *Continuous special inspections* shall be performed during installation of *helical pile* foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the *registered design professional* in responsible charge. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professional* shall be used to determine compliance.

Exception ~~Exceptions~~:

~~1. *Helical pile* foundations for *ground-mounted photovoltaic (PV) panel systems* serving Group R-3 buildings.~~

~~2.~~ The *building official* shall be permitted to modify or exempt *special inspection* requirements for *helical pile foundations* for *ground-mounted photovoltaic panel systems*.

Commenter's Reason: The original proposal sought to exempt PV panel systems serving Group R-3 buildings from Special Inspection requirements for deep foundations. Although we were not expecting any opposition on this one point, some testifiers felt this is "tying the hands" of the building official. This public comment completely strikes out the requested exemption for Group R-3, and instead relies on the existing Exception 1 to Section 1704.2 that states: "Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official."
The second sentence of the original proposal remains, as it provides flexibility to the building official without taking anything away. The existing language in Tables 1705.7 and 1705.8 and Section 1705.9 is interpreted by a very small minority of building departments as "tying the hands" of the building official. Continuous special inspection is not practical and has no added value when tens of thousands of very small individual deep foundation elements are used for large-scale PV facilities.

This proposal and this public comment seek to provide flexibility for the building official to make their own judgment call regarding modifying the requirement to periodic special inspections, or to provide an exemption from special inspection for small projects, depending on the type of foundation proposed, the construction techniques, and the site conditions.

For additional information regarding Special Inspections for PV facility foundations, we refer the reader to our original Reason Statement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and the public comment seek to formalize the Special Inspection criteria that is the most common across the U.S. For the vast majority of AHJs, the net effect of the public comment and code change proposal will not increase or decrease the cost of construction. However, for those AHJs who presently feel they have no choice and no flexibility to modify Special Inspection criteria, the net effect could be to decrease the cost of construction.

Public Comment# 3473

S157-22

IBC: 1807.2.5 (New), 1807.2.5.1 (New), 1807.2.5.2 (New), 1807.2.5.3 (New)

Proposed Change as Submitted

Proponents: Peter Zvingilas, representing Region VI; John Grenier, representing National Council of Structural Engineers Associations (NCSEA) (jgrenier@greniereng.com)

2021 International Building Code

Add new text as follows:

1807.2.5 Guards at retaining walls. *Guards* shall be provided in accordance with Sections 1807.2.5.1 through 1807.2.5.3.

1807.2.5.1 Guards. A *guard* shall be located along the top of a retaining wall located along open-sided walking surfaces that are located more than 30 inches (762 mm) measured vertically to the surface or grade below at the exposed face of the retaining wall. *Guards* shall be adequate in strength and attachment in accordance with Section 1607.9.

Exceptions:

1. Where other barrier(s) are provided that is approved by the *building official*.
2. Where a retaining wall is located where it is not accessible to the public, as determine by the *building official*, a *guard* shall not be required.

1807.2.5.2 Height. Required *guards* at retaining walls shall comply with the height requirements of section 1015.3.

1807.2.5.3 Opening limitations. Required *guards* shall comply with the opening limitations of Section 1015.4.

Reason: To add language to clarify where and how a guard is to be installed on top of a retaining wall that would pose a danger of a fall.
1. The code is currently silent on the requirement for guards on top of retaining walls. These conditions commonly occur on sites (not necessarily buildings that are addressed in Chapter 10) at public places (parks; schools; etc.) that need to have guards.

2. The exception #2 provides a method for conditions where a retaining wall is not accessible to the public and a guard would not be warranted and would be wasteful.

3. Section 1807.2.5.3 Opening Limitations, provides a method to allow the 21” sphere criteria to be used for certain non-public occupancies (industrial sites, etc.).

4. The 30” height requirement is consistent with section **1015.2**; and section **105.2 Work exempt from permit**, items #4 (retaining walls less than 4’ do not require a permit, however that is measured from the bottom of the footing so the grade difference would essentially be 30”), and item # 6 (which is where a sidewalk or driveway with over a 30” grade change would be required to be permitted).

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The cost of construction will not increase by this change. This change clarifies what is already being done in the industry.

S157-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

1807.2.5 Guards ~~at retaining walls~~. *Guards* shall be provided at retaining walls in accordance with Sections 1807.2.5.1 through 1807.2.5.3.

Exception: Guards are not required at retaining walls not accessible to the public.

1807.2.5.1 ~~Guards~~ Where required. At retaining walls located within 36 inches (914mm) of walking surfaces, a *guard* shall be required between the walking surface and the open side of the retaining wall where the walking surface is ~~located along the top of a retaining wall located along open-sided walking surfaces that are~~ located more than 30 inches (762 mm) measured vertically to the surface or grade below ~~at the exposed face of the retaining wall~~ at any point within 36 inches (914mm) horizontally to the edge of the open side . *Guards* shall ~~be adequate in strength and attachment~~

~~in accordance~~ comply with Section 1607.9.

~~**Exceptions:**~~

1. ~~Where other barrier(s) are provided that is approved by the *building official*.~~
2. ~~Where a retaining wall is located where it is not accessible to the public, as determine by the *building official*, a *guard* shall not be required.~~

Committee Reason: Approved as modified as this proposal is an important update from a safety aspect. The committee expressed concerns relative to this being a 'site' item vs. a building component. The modification provides needed restructure, clarification and alignment with current code language. (Vote: 11-2)

S157-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1807.2.5.1

Proponents: Jeffrey Munsterteiger, representing National Association of Home Builders (jmunsterteiger@nahb.org) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1807.2.5.1 Where required. At retaining walls other than at area wells serving *emergency escape and rescue openings*, located within 36 inches (914mm) of walking surfaces, a guard shall be required between the walking surface and the open side of the retaining wall where the walking surface is located more than 30 inches (762 mm) measured vertically to the surface or grade below at any point within 36 inches (914mm) horizontally to the edge of the open side. Guards shall comply with Section 1607.9.

Commenter's Reason: The stated purpose of the International Building Code (IBC) is to establish minimum requirements to provide a reasonable level of life safety and property protection from dangerous conditions, among other objectives. This proposal as modified by this public comment provides a reasonable level of life safety by providing an effective minimum requirement.
In section 1807.2.5.1 it is clarified that guards are not required at retaining walls creating area wells that serve emergency escape and rescue openings. This is added to address a concern from a committee member that the proposal would inappropriately capture these area wells. Particularly in residential buildings the EERO could be a window in a relatively shallow area well. A guard around the area well could impede emergency egress by residents or access by the fire service, even if a gate were provided.

This revision will focus the provision on retaining walls located away from buildings and larger areaways intended to provide space for mechanical equipment or natural light while preserving the need to facilitate emergency egress and rescue operations.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code proposal together with the public comment will increase the cost of construction for retaining walls not attached to a building or for large areaways adjacent to a building. However, there will be no cost impact for small area wells serving EERO's as they will be exempt from guard requirements.

Public Comment# 3095

Public Comment 2:

IBC: 1807.2.5.2

Proponents: Jeffrey Munsterteiger, representing National Association of Home Builders (jmunsterteiger@nahb.org) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

1807.2.5.2 Height. Required *guards* at retaining walls shall comply with the height requirements of section 1015.3. Where a required guard is placed on top of a retaining wall, the vertical height of the retaining wall above the walking surface shall be permitted to be counted towards the required guard height.

Commenter's Reason: The stated purpose of the International Building Code (IBC) is to establish minimum requirements to provide a reasonable level of life safety and property protection from dangerous conditions, among other objectives. This proposal as modified by this public comment provides a reasonable level of life safety by providing an effective minimum requirement.
Text is added to Section 1807.2.5.2 to clarify that where the required guard is placed on top of a retaining wall the total height of the wall and guard together need not exceed the minimum height required in the section. This would allow a short projection of the retaining wall to count towards the guard height. Among other benefits, this could reduce the magnitude of guard loads that need to be transferred to the wall and save the cost of providing a full 36" or 42" height guard on top of a wall that could already be as much as a foot above the walking surface.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Where a guard will be required at a retaining wall, where one wasn't previously required, the cost of construction will increase. Approving this modification will lessen the impact of those costs while still providing an effective barrier.

Public Comment# 3361

S161-22

IBC: 1808.2

Proposed Change as Submitted

Proponents: John-Jozef Proczka, representing Self (john-jozef.proczka@phoenix.gov)

2021 International Building Code

Revise as follows:

1808.2 Design for capacity and settlement. Foundations shall be so designed that the allowable vertical and lateral bearing ~~capacity~~ capacities of the soil are ~~is~~ not exceeded, the sliding resistance is not exceeded, and that differential settlement is minimized. Where geotechnical investigations are conducted, the allowable bearing capacities and sliding resistance of the soil shall not exceed the values in the geotechnical report. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808.6 .

Reason: There are two proposed changes:
1. Clarify that where geotechnical investigations are conducted that the soil capacity then needs to be in accordance with the values shown in the report from Section 1803.6. This would not allow the presumptive load-bearing values of the soil to be used where a registered design professional has determined the soil at the site is not sufficient to use those values. It should be noted that geotechnical reports rarely report smaller values than the presumptive values, but where they do it is inappropriate to use presumptive values.

2. Alter the wording such that recognition of vertical and lateral bearing capacities of the soil and lateral sliding resistance of the soil are all specifically invoked, where before they had to be assumed to be contained simply in "allowable bearing capacity".

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction on sites that have a geotechnical investigation and that investigation discovers that the soil at the site is worse than the presumptive load bearing values present in the code. This situation is rare.

S161-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the committee disagreed with the proposal adding an additional trigger for sliding. (Vote: 11-3)

S161-22

Individual Consideration Agenda

Public Comment 1:

Proponents: John-Jozef Proczka, representing Self (john-jozef.proczka@phoenix.gov) requests As Submitted

Commenter's Reason: The original proposal is correct and appropriate as stated. The committee's stated rationale for denial was for the sliding resistance being added - however sliding of foundations is a failure mode that should be satisfied for foundations, and it is already given a value to check against in the presumptive load-bearing values table.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The original proposal's cost impact statement is appropriate.

Public Comment# 3174

S164-22

IBC: 1809.7, TABLE 1809.7, 1809.8, 1809.9

Proposed Change as Submitted

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org)

2021 International Building Code

Revise as follows:

1809.7 Prescriptive footings for light-frame construction. Where a specific design is not provided, concrete or masonry-unit footings supporting walls of *light-frame construction* shall be permitted to be designed in accordance with Table 1809.7. The *light-frame construction* supported by these footings shall comply with all of the following:

1. The light frame construction shall be designed in accordance with Section 2211.1.2, 2308, or 2309.
2. The light frame construction shall not exceed the limitations specified in Section 2308.2.
3. Floor and roof framing tributary width shall not exceed 16 feet (4877 mm), with an additional maximum roof overhang of 2 feet (610 mm).
4. The soil shall not be expansive and shall have a minimum allowable vertical bearing pressure of 1,500 psf (71.8 kN/m^2).

TABLE 1809.7 PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION[a, b, c, d, e, f]

NUMBER OF FLOORS AND ROOFS SUPPORTED BY THE FOOTING~~[f]~~	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	~~18~~ 23	8~~[g]~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section 1809.4.

b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.

c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.

d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.

e. For thickness of foundation walls, see Section 1807.1.6.

f. ~~Footings shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.~~ Footing projections shall not exceed the thickness of the footing.

~~g. Plain concrete footings for Group R-3 occupancies shall be permitted to be 6 inches thick.~~

1809.8 Plain concrete footings. The edge thickness of plain concrete footings supporting walls ~~of other than *light-frame construction*~~ shall be not less than 8 inches (203 mm) where placed on soil or rock.

~~Exception~~ Exceptions:

1. For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.
2. The edge thickness of plain concrete footings shall be permitted to be designed in accordance with Section 1809.7.

1809.9 Masonry-unit footings. The design, materials and construction of masonry-unit footings shall comply with Sections 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings shall be permitted to be designed in accordance with Section 1809.7 ~~supporting walls of *light-frame construction* shall be permitted to be designed in accordance with Table 1809.7~~.

Reason: *Light-frame construction* is only defined by the repetitive nature of its structural elements and has no tie to loading.
This footing table is intended to only be applied to lightly loaded prescriptive construction, but the wording of the section currently allows any type of *light-frame construction*.

There are many buildings with very heavy foundation loads that meet the definition of *light-frame construction* and are not appropriate to place on the prescriptive foundations in Table 1809.7. This is also true with highly loaded shear walls. This proposal clarifies that the intent of these prescriptive provisions is tied with conventional-similar light-frame construction of Section 2308.

The limitations placed on these footings are taken from the limitations of *conventional light-frame construction* but also includes the tributary widths that are used in the IRC prescriptive footing tables. These limitations are necessary as AWC's WFCM and AISI's S230 allow higher snow load, wind load, and seismic design categories than are present in *conventional light-frame construction*. Additionally, no identified tributary width currently exists for the use of this table.

This table's ability to be used with a roof in addition to the number of floors being supported is removed as when calculating the foundations - it was found not to conform to code limits for soil bearing. The similar table that existed in the 2012 IRC and its previous versions limited the number of stories of the building – not the number of floors supported. This change reduces the table from being able to support a 4-story building to a 3-story building, which aligns with the 2012 IRC foundation table as well as the conventional light-frame construction limitations. The only additional change needed to make the table work was for the width that supports a three-story building and the change aligns with the 2012 IRC footing table.

Section 1808.6 would still be applicable to expansive soils, so this table should not apply to those soils. However, other questionable soil will require a geotechnical investigation where the allowable vertical foundation bearing pressure could be determined to be at least 1,500psf to use this table.

The changes to 1809.8 and 1809.9 are necessary to invoke the same limitations as the base section where masonry and plain concrete footings are used.

The restriction of the footing projection thickness is taken from IRC limitations of the same thing.

This proposal is submitted by the ICC Building Code Action Committee (BCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2020 and 2021 the BCAC has held several virtual meetings open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the BCAC website at https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/building-code-action-committee-bcac/.

Cost Impact: The code change proposal will increase the cost of construction
This proposal clarifies that the intent of the table is only to be applied to **lightly loaded** prescriptive construction, not for any type of *light-frame construction as stated in the 2021 IBC. Light-frame construction is* defined by the repetitive nature of its structural elements and has no tie to loading.

Clarifying the table limitations will ensure the table is not used for larger, more heavily-loaded light-frame structures that would overload the tabulated footing sizes, or in high-wind and high-seismic conditions where footings supporting the lateral force-resisting system need to be designed for such forces.

This code change proposal will increase the cost of construction by requiring non-prescriptive design of footings supporting structures that do not meet the clarified limitations.

S164-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal as worded is confusing and needs rewording for clarity. (Vote: 10-4)

S164-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1809.7, TABLE 1809.7, 1809.8, 1809.9

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1809.7 Prescriptive footings for light-frame construction. Where a specific design is not provided, concrete or masonry-unit footings supporting walls of *light-frame construction* shall be permitted to be designed in accordance with Table 1809.7. The *light-frame construction* supported by these footings shall comply with all of the following:

1. The light frame construction shall be ~~designed~~ in accordance with Section 2211.1.2, 2308, or 2309.
~~2. The light frame construction shall not exceed the limitations specified in Section 2308.2.~~
2. Maximum floor-to-floor height shall not exceed 11 feet, 7 inches (3531 mm).
3. Average *dead load* shall not exceed 15 psf (718 N/m²) for combined roof and ceiling, *exterior walls*, floors, and partitions.
4. *Live loads* shall not exceed 40 psf (1916 N/m²) for floors.

5. Ground snow loads shall not exceed 50 psf (2395 N/m²).

6. Basic design *wind speed* shall not exceed 130 miles per hour (57 m/s).

7. The *Seismic Design Category* is A or B.

8. The *risk category* is I or II.

~~3.~~ 9. Floor and roof framing tributary width shall not exceed 16 feet (4877 mm), with an additional maximum roof overhang of 2 feet (610 mm).

~~4. The soil shall not be expansive and shall have a minimum allowable vertical bearing pressure of 1,500 psf (71.8 kN/m²).~~

TABLE 1809.7 PRESCRIPTIVE FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION[a, b, c, d, e, f]

~~NUMBER OF FLOORS AND ROOFS SUPPORTED BY THE FOOTING~~	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1- story[g]	12	6
2-story[g]	15	6
3-story[g]	23	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section 1809.4.

b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.

c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.

d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.

e. For thickness of foundation walls, see Section 1807.1.6.

f. Footing projections shall not exceed the thickness of the footing.

g. *Mezzanines* and *equipment platforms* that are supported by these footings shall be considered an additional story only when determining these minimum footing sizes.

1809.8 Plain concrete footings. The edge thickness of plain concrete footings supporting walls shall be not less than 8 inches (203 mm) where placed on soil or rock.

Exceptions:

1. For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.
2. The edge thickness of plain concrete footings shall be permitted to be designed in accordance with Section 1809.7.

1809.9 Masonry-unit footings. The design, materials and construction of masonry-unit footings shall comply with Sections 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings shall be permitted to be designed in accordance with Section 1809.7 .

Commenter's Reason: The reasons expressed in the original proposal are still the same and the intent is not changing, but this public comment is attempting to clarify the provisions based on feedback received at the Committee Action Hearings by:
1) There was confusion about the reference to section 2308.2 as this table also applies to the footings supporting cold-formed steel light-frame construction walls. This PC restates the limitation to avoid any confusion for the code users.
2) There was a concern that the word “design” in the first item could be misunderstood as an engineer needed to be involved. That is not the case. This PC deletes the word “design” from the first item as there.

3) There was concern expressed by the committee that the wording of the number of floors and roofs supported by the footing would impact platform framed buildings inappropriately. To address this concern the wording describing the numbers of stories of the building has been changed to align with the wording seen in the 2012 IRC Table R403.1.

4) A footnote g is added to the stories column to clarify that although not a story, mezzanines and equipment platforms that load these footings should be considered as stories in order to capture the load that they will impart to these footings.

5) Additionally, there was concern that the provisions stating that the soil shall not be expansive and shall have a minimum bearing capacity would require a geotechnical investigation. This is not the intent and the deletion of this limitation keeps the minimums present elsewhere in the code, so this limitation does not need to be restated here.

6) Finally, There was confusion during the previous hearings that the values of tributary width were not based on anything. This is not the case, the tributary width seen in this proposal is the same value used to develop the IRC footing tables. The footing sizes in the IRC are based on 18 feet of tributary roof width and 16 feet of tributary floor width as directly stated in the commentary to those tables.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment makes no technical changes to code change proposal S164-22, but simply places the limitations within this section and it addresses confusing language brought up by the structural committee.

This proposal clarifies that the intent of the table is only to be applied to **lightly loaded** prescriptive construction, not for any type of *light-frame construction as stated in the 2021 IBC. Light-frame construction is* defined by the repetitive nature of its structural elements and has no tie to loading. *The cost of construction will be impacted as below:*

1) No increase in cost: In most cases where the intent of the table has already been followed, there will not be an increase in construction cost.

2) Could cause an increase in cost: Where the code requirements may have been misused for larger, more heavily-loaded light-frame structures that would overload the tabulated footing sizes, or in high-wind and high-seismic conditions where footings supporting the lateral force-resisting system need to be designed for such forces.

Clarifying the table limitations will cause some of the previously misused conditions to be outside the scope of the prescriptive design of the table.

Public Comment# 3098

S168-22

IBC: 1810.3.3.2

Proposed Change as Submitted

Proponents: Daniel Stevenson, representing GeoCoalition; Lori Simpson, representing GeoCoalition (lsimpson@langan.com)

2021 International Building Code

Revise as follows:

1810.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single *deep foundation* element or a group thereof shall be determined by an *approved* method of analysis or by lateral load tests to not less than twice the proposed design working *load*. The resulting allowable lateral *load* shall not be more than one-half of the *load* that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of the foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity. When piles are used in groups, group effects shall be evaluated in accordance with Section 1810.2.5.

Reason:

- In the second sentence, "allowable load" is revised to "allowable lateral load" to clarify that the subject is allowable lateral load, and not allowable axial load.
- When a load test is performed on a single foundation element, engineers may not realize that the results usually need to be adjusted for elements used in groups. A sentence was added to the end of this section to clarify that group effects still must be evaluated for foundation elements used in groups.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal only clarifies existing code requirements.

S168-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal's added pointer to Section 1810.2.5 may not be appropriate. (Vote: 11-3)

S168-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1810.3.3.2

Proponents: Daniel Stevenson, representing GeoCoalition (dstevenson@berkelapg.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1810.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single *deep foundation* element or a group thereof shall be determined by an *approved* method of analysis or by lateral load tests to not less than twice the proposed design working *load*. The resulting allowable lateral *load* shall not be more than one-half of the *load* that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of the foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity. ~~When piles are used in groups, group~~ Group effects shall be evaluated ~~in accordance with~~ where required by Section 1810.2.5.

Commenter's Reason: The language in the original proposal is problematic, as it says "...group effects shall be evaluated in accordance with section 1810.2.5." However, section 1810.2.5 does not say how to evaluate group effects. It only says where group effects must be evaluated.

The proposed language has been revised to accurately reflect the requirements of 1810.2.5.
The added sentence is needed because many foundation designers fail to realize that group effects must be evaluated when determining the lateral capacity of deep foundation elements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal clarifies existing code requirements.

Public Comment# 3521

S173-22

IBC: 1901.2, SECTION 1907, 1907.1 (New), 1907.2 (New), 1907.1

Proposed Change as Submitted

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

2021 International Building Code

Revise as follows:

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. ~~Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical *loads* or lateral forces from other parts of the structure to the soil.~~

SECTION 1907

~~MINIMUM SLAB PROVISIONS~~ SLABS-ON-GROUND

Add new text as follows:

1907.1 General. Non-structural slabs-on-ground shall comply with Section 1904 and this Section. Structural slabs-on-ground shall comply with all applicable provisions of this Chapter. Slabs-on-ground shall be considered structural where designed to one of the following:

1. Transmit loads or resist lateral forces from other parts of the structure to the soil.
2. Transmit loads or resist lateral forces from other parts of the structure to foundations
3. Serve as tributary area for resisting uplift or overturning forces.

1907.2 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3½ inches (89 mm).

Revise as follows:

~~1907.1~~ 1907.3 ~~General~~ Vapor retarder. ~~The thickness of concrete floor slabs supported directly on the ground shall be not less than 3½ inches (89 mm).~~ A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where *approved* based on local site conditions.

Reason: This proposal:

1. Renames Section 1907 to “Slabs-on-Ground” as this section is not applicable to interim floor slabs or other slabs not on ground.

2. Moves all slab-on-ground requirements into one section by eliminating text in section 1901.2

3. Clarifies scenarios where slabs-on-ground are structural, adding language that addresses slabs on ground used as part of a diaphragm systems, transferring loads to micro-piles, etc. and as dead weight to resist overturning or uplift forces.

4. The proposal divided the existing text of 1907.1 into two sections. 1907.2 for the thickness of concrete floor slabs and 1907.3 for Vapor retarder.

This proposal is submitted by the ICC Building Code Action Committee (BCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2020 and 2021 the BCAC has held several virtual meetings open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the BCAC website at https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/building-code-action-committee-bcac/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change is a clarification of the requirements

S173-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as this proposal could setup a potential disconnect with ACI 318. The idea of 'vertical loads' should not be deleted. The committee did appreciate the concept of consolidating all the provisions for slabs-on-ground. (Vote: 9-5)

S173-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1901.2, SECTION 1907, 1907.1, 1907.2 (New), 1907.2, 1907.3

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code.

SECTION 1907
SLABS-ON-GROUND

1907.1 ~~General~~ Structural slabs-on-ground . ~~Non-structural slabs-on-ground shall comply with Section 1904 and this Section.~~ Structural concrete slabs-on-ground shall comply with all applicable provisions of this Chapter. Slabs-on-ground shall be considered structural concrete where required by ACI 318 or where designed to : ~~one of the following:~~

1. Transmit vertical loads or ~~resist~~ lateral forces from other parts of the structure to the soil~~.~~ or
2. Transmit vertical loads or ~~resist~~ lateral forces from other parts of the structure to foundations
3. ~~Serve as tributary area for resisting uplift or overturning forces.~~

1907.2 Non-structural slabs on ground. Non-structural slabs-on-ground shall only be required to comply with Sections 1904.2, 1907.3, and 1907.4. Portions of the non-structural slabs on ground used to resist uplift forces or overturning shall be designed in accordance with accepted engineering practice throughout the entire portion designated as dead load to resist uplift forces or overturning.

~~1907.2~~ 1907.3 Thickness. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3½ inches (89 mm).

~~1907.3~~ 1907.4 Vapor retarder. A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other *approved* equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.

3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where *approved* based on local site conditions.

Commenter's Reason: The committee expressed interest in having these concepts move forward in the code development process. The committee raised several concerns that are addressed in the public comment. In response to testimony the committee recommended four items be addressed:

1. The word “vertical” be inserted in front of “loads” in items 1 and 2.

2. Provides specific language referring to structural slabs as scoped by ACI 318.

3. Removes the word “resist” from item 1 and 2 to create a more logical sentence structure.

4. The committee thought the use of “tributary area” could create confusions and that the language in this public comment removes this item as a structural concrete designation and better describes portions of slabs used for deadweight to resist uplift or overturning where they are not structural concrete, but do need to be designed for whatever load effects need to be resisted that are induced from those applied uplift forces. These would frequently be bending and shear where the slab needs to cantilever beyond the face of the foundation below that is undergoing uplift.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This code change, as modified in the PC, is a clarification of the requirements for slab on ground and will not impact the cost of construction.

Public Comment# 3140

S174-22

IBC: 1901.2, 1901.2.1 (New), ACI Chapter 35 (New), ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org); Jerzy Zemajtis, representing NEx, An ACI Center of Excellence for Nonmetallic Building Materials (jerzy.zemajtis@nonmetallic.org); John Busel, representing American Composites Manufacturers Association (jbusel@acmanet.org); Scott Campbell, representing NRMCA (scampbell@nrmca.org); Doug Gremel, representing Owens Corning Infrastructure Solutions (douglas.gremel@owenscorning.com); Carl Larosche, representing ACI (clarosche@wje.com); William O'Donnell, representing DeSimone Consulting Engineers (william.odonnell@de-simone.com); Matthew D'Ambrosia, representing MJ2 Consulting (matt@mj2consulting.com); Keith Kesner, representing CVM (kkesner3006@gmail.com); antonio de luca, representing Thornton Tomasetti

2021 International Building Code

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical *loads* or lateral forces from other parts of the structure to the soil.

Add new text as follows:

1901.2.1 Structural concrete with GFRP reinforcement. Cast-in-place structural concrete internally reinforced with glass fiber reinforced polymer (GFRP) reinforcement conforming to ASTM D7957 and designed in accordance with ACI CODE 440 shall be permitted only for structures assigned to Seismic Design Category A.

Add new standard(s) as follows:

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

CODE 440-22	Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars – Code Requirements

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

D7957/D7957M-17	Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement

Reason: This proposal adds a new referenced standard: ACI CODE 440-22: *Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars – Code Requirements*.
The addition of this new standard allows the design and construction of cast-in-place reinforced concrete using non-metallic reinforcement bars. Currently the design and construct requirements contained in the standard are limited to use in Seismic Design Category A. ACI Committee 440 developed this standard to provide for public health and safety by establishing minimum requirements for strength, stability, serviceability, durability, and integrity of GFRP reinforced concrete structures.

The standard not only provides a means of establishing minimum requirements for the design and construction of GFRP reinforced concrete, but for acceptance of design and construction of GFRP reinforced concrete structures by the building officials or their designated representatives.

The standard applies to GFRP reinforced concrete structures designed and constructed under the requirements of the general building code.

GFRP reinforced concrete is especially beneficial for satisfying a demand for improved resistance to corrosion in highly corrosive environments, such as reinforced concrete exposed to salt water, salt air, or de-icing salts.

This standard establishes minimum requirements for GFRP reinforced concrete in a similar fashion as ACI 318 Building Code Requirements for Structural Concrete establishes minimum requirements for structural concrete reinforced with steel reinforcement. A separate standard is needed, as GFRP reinforcement behaves differently than steel reinforcement.

Currently GFRP is accepted for use to reinforce highway bridge decks. Acceptance is primarily in areas where deicing salts are used on the roads and cause severe corrosion to conventional steel reinforcement. This proposed change provides minimum requirements for other applications where GFRP reinforced concrete is being considered, such as marine and coastal structures, parking garages, water tanks, and structures supporting MRI machines. Design reasons to use GFRP bars in structures are: resistance to corrosion in the presence of chloride ions, lack of interference with electromagnetic fields, and low thermal conductivity.

Currently the standard prohibits the use concrete internally reinforced with GFRP for applications where fire resistance ratings are required. Chapter 6 of the International Building code cites applications for floors, roofs, walls, partitions and primary and secondary structural frames where a fire resistance ratings are not required.

The code requirements may be viewed at: https://www.concrete.org/publications/standards/upcomingstandards.aspx

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds alternative materials for the design and construction of reinforced structural concrete in Seismic Design Category A and does not preclude the use of conventional reinforced concrete. Thus there is no cost impact.

Staff Analysis: A review of the standard proposed for inclusion in the code, ACI CODE 440-22 Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars – Code Requirements, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.
A review of the standard proposed for inclusion in the code, ASTM D7957/D7957M-17 Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S174-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposed new standard, ACI Code 440-22, is not complete and was submitted in draft format only. The committee commented that testimony indicated the final version of the standard, ACI Code 440-22, may have substantive changes related to fire resistance of FRP. (Vote: 14-0)

S174-22

Individual Consideration Agenda

Public Comment 1:

IBC: 1901.2.1, ACI Chapter 35

Proponents: Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org); John Busel, representing American Composites Manufacturers Association (jbusel@acmanet.org); Doug Gremel, representing Owens Corning Infrastructure Solutions (douglas.gremel@owenscorning.com); Keith Kesner, representing CVM (kkesner3006@gmail.com); Antonio Nanni, representing University of Miami (nanni@miami.edu); William O'Donnell, representing DeSimone Consulting Engineers (william.odonnell@de-simone.com) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

1901.2.1 Structural concrete with GFRP reinforcement. Cast-in-place structural concrete internally reinforced with glass fiber reinforced polymer (GFRP) reinforcement conforming to ASTM D7957 and designed in accordance with ACI CODE 440<u>.11</u> shall be permitted <u>where fire resistance ratings are not required and</u> only for structures assigned to Seismic Design Category A.

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

CODE 440<u>.11</u>-22	Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars – Code Requirements

Commenter's Reason: The committee voted for disapproval for two reasons: 1) the ACI CODE 440.11 Structural Concrete Buildings Reinforced Internally with Fiber Reinforced Polymer (FRP) Bars - Code Requirements was in public review draft and 2) there was concern about application where fire resistance ratings are required. ACI CODE 440.11-22 has been completed and the revised designation is reflected in this pulbic comment. Further, this public comment adds clear language precluding design of structural concrete in accordance with ACI CODE 440.11 where fire resistance ratings are required. This public comment addresses both concerns expressed by the committee. There are many applications where the use of GFRP reinforcement in concrete can enhance durability and long term life safety.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal as modified with public comment provides an additional option for the design and consturction of reinforced structural concrete.

Staff Analysis: In accordance with Section 3.6.3.1.1 of ICC Council Policy 28, the new referenced standard ACI Code 440-22, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

Public Comment# 3212

S178-22

IBC: [BS] 202, SECTION 202, SECTION 202 (New), TABLE 1903.5.1 (New), 1903.5.2 (New), 1903.5 (New), 1903.5.1 (New), 2103.1.2 (New), 2205.3 (New), 2205.3.1 (New), 2205.3.2 (New), TABLE 2205.3.3 (New), 2303.8 (New), 2403.6 (New), 2205.3.3 (New), ASTM Chapter 35 (New), ISO Chapter 35 (New)

Proposed Change as Submitted

Proponents: Webly Bowles, representing New Buildings Institute (webly@newbuildings.org); Kimberly Cheslak, NBI, representing NBI (kim@newbuildings.org); jim edelson, representing NBI (jim@newbuildings.org)

Add new definition as follows:

CONCRETE, LIGHTWEIGHT. *Concrete* containing lightweight aggregate and having an equilibrium density determined by ASTM C567.

2021 International Building Code

Revise as follows:

[BS] CONCRETE. Mixture of cementitious material, fine aggregate, coarse aggregate and water, with or without admixture.

Carbonate aggregate. Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40 percent or less quartz, chert or flint.

Cellular. A lightweight insulating concrete made by mixing a preformed foam with Portland cement slurry and having a dry unit weight of approximately 30 pcf (480 kg/m^3).

Lightweight aggregate. Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m^3).

Perlite. A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m^3) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

Sand-lightweight. Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m^3).

Siliceous aggregate. Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40-percent quartz, chert or flint.

Vermiculite. A light weight insulating concrete made with *vermiculite* concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a Portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m^3).

2021 International Building Code

Add new definition as follows:

CARBON DIOXIDE EQUIVALENT (CO2e). A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO2e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO2). GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2. The following GWP values are used based on a 100-year time horizon: 1 for CO2, 25 for methane (CH4), and 298 for nitrous oxide (N2O).

COMMUNITY RENEWABLE ENERGY FACILITY. A facility that produces energy harvested from *renewable energy resources* and is qualified as a community energy facility under applicable jurisdictional statutes and rules.

FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA). A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a "financial power purchase agreement" and "virtual power purchase agreement."

FLAT GLASS. A type of glass, initially produced in plane form. Common uses include, but are not limited to, windows, glass doors, and transparent walls. Flat glass is in contrast to container glass, glass fiber (insulation) and optical communication. Flat glass has a higher magnesium oxide and sodium oxide content than container glass and a lower silica, calcium oxide, and aluminum.

ON-SITE RENEWABLE ENERGY. Energy from *renewable energy resources* harvested at the building site.

PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA). A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.

PLATE GLASS. See “Flat glass”

RENEWABLE ENERGY RESOURCES. Energy from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.

SHEET GLASS. See “Flat glass”

Add new text as follows:

TABLE 1903.5.1
CO2e LIMITS IN MIXTURE

Specified compressive strength f'c, psi	Maximum kg/m^3 (SI)	High-early strength Maximum kg/m^3 (SI)	Lightweight concrete Maximum kg/m^3 (SI)
up to 2499	302	408	578
2500-3499	382	516	578
3500-4499	432	583	626
4500-5499	481	649	675
5500-6499	505	682	N/A
6500 and greater	518	680	N/A

1903.5.2 CO2e Limit Method - Project. Total CO2e ($CO2e_{proj}$) of all *concrete* placed at the building project shall not exceed the project limit ($CO2e_{allowed}$) determined using Table 1903.5.1 and Equation 1903.5.2

Equation 1903.5.2
$CO2e_{proj} < CO2E_{allowed}$

where: $CO2E_{proj} = \Sigma CO2E_n v_n$ *and* $CO2E_{allowed} = \Sigma CO2E_{lim} v_n$
and

n = the total number of *concrete* mixtures for the project

$CO2E_n$ = the global warming potential for mixture n per mixture EPD, kg/m^3

$CO2E_{lim}$ = the global warming potential limit for mixture n per Table 1903.5.1, kg/m^3

v_n = the volume of mixture n *concrete* to be placed

1903.5 Embodied CO2e of concrete materials. *Concrete* products used in the building project shall be in accordance with Sections 1903.5.1 or 1903.5.2.

Exceptions:

1. Precast concrete.
2. *Masonry units* complying with Section 2103.1.2.
3. Projects where no *concrete* suppliers with product-specific environmental product declarations (EPD) for *concrete* are located within 100 miles of the project site, where Type III industry-wide EPDs and an inventory of CO2e values for all concrete mixes are provided to the AHJ.

1903.5.1 CO2e Limit Method - Mixture. The total CO2e of the *concrete* mixes used in the project shall not exceed the value given in Table 1903.5.1 based on the compressive strength of the product. CO2e content shall be documented by a product-specific Type III Environmental Product Declaration (EPD) for each product. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

2103.1.2 Embodied CO2e disclosure of masonry units. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *masonry units*, by cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

2205.3 Embodied CO2e of steel products. Structural steel, hollow steel section, steel plate, and concrete reinforcing steel bar products used in the *building* shall comply with Section 2205.3.1, and one of either 2205.3.2 or 2205.3.3.

2205.3.1 EPD Disclosure. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of steel products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

2205.3.2 Steel Production. A minimum of 75% of steel products listed in this section, based on cost, shall be produced in a facility or facilities that comply with one of the following:

1. On the date of procurement is independently, or as part of an aggregation of facilities, a Green Power Partner in the United Stated Environmental Protection Agency (U.S. EPA) Green Power Partnership program, or an equivalent renewable power procurement registry as approved by the AHJ.
2. Not less than 50% of the energy sourced for production at the facility is a *renewable energy resource* as documented from one or more of the following:

   2.1. *On-site renewable energy* system

   2.2. Off-site renewable energy system owned by the production facility owner

   2.3. *Community renewable energy facility*

   2.4. *Physical Renewable Energy PPA*

   2.5. *Financial Renewable Energy PPA*

TABLE 2205.3.3
CO2e LIMIT PER STEEL PRODUCT

	Steel Product	Mill kg CO2e/kg[a]	Fabrication kg CO2e/kg[b]
Structural Steel	Structural Sections	0.99	1.22
Structural Steel	Hollow Structural Sections	1.71	1.99
Structural Steel	Plate	1.47	1.73
Concrete Reinforcing Bars		0.89	0.98

a. Applies when an EPD declares mill-only material (cradle to mill gate).

b. Applies when an EPD declares mill material plus U.S. industry average fabrication impacts (cradle to fabricator gate).

2303.8 Embodied CO2e disclosure of wood products. Environmental Product Declarations (EPD) shall be submitted for 75% of wood products and members, based on cost. Type III EPDs us ed for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

2403.6 Embodied CO2e disclosure of glass products. Type III Environmental Product Declarations (EPD)shall be submitted for 75% of *flat glass* products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

2205.3.3 Steel Product CO2e Limits. A minimum of 75% of steel products, based on cost, shall not exceed the total CO2e values in Table 2205.3.3 based on product type.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

C567/C567M-19 Standard Test Method for Determining Density of Structural Lightweight Concrete

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedure

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and service

Reason: 1903.5 Embodied CO2e of concrete materials:

Language in this proposal builds on the success of the Marin County Low Carbon Concrete Code[1], setting achievable targets based on current U.S.-based EPDs. The CO2e limits are set on the 75th percentile of the concrete GWPs evaluated, meaning, 75% of the GWP values (not 75% of the EPDs) comply with the limits set. The values encourage the lowest 25% of the U.S. market's concrete to perform and report improved performance through EPDs. Several nationally available alternative manufacturing processes and materials provide opportunities to reduce concrete's embodied carbon. Alternative cements and supplementary cementitious materials, aggregate sourcing, chemical admixtures, and plant efficiency are a few of the opportunities for creating lower embodied carbon concrete.

Concrete is one of the top two materials in building construction and a primary contributor to embodied carbon in buildings. A recent case study analysis by RMI shows that simply by specifying concrete products with lower CO2e content, the embodied carbon of a commercial construction project can be reduced up to 33%.[2]

To build a building, construction professionals buy concrete (which contains cement used with water as a binder to adhere particles of sand and rock, known as aggregate) from a ready-mix supplier. Although each of concrete's constituent materials offer opportunities for reductions in embodied carbon, the high embodied carbon of concrete is primarily driven by the manufacture of one key ingredient—ordinary Portland cement. Portland cement is the most common cementitious binder used in concrete mixtures in the U.S., and the U.S. cement industry is one of the largest contributors to U.S.-borne emissions at 68.3 million metric tons (MMT) of CO2e per year.[3] The building construction industry's demand for concrete accounts for an estimated 51% of total Portland cement produced in the U.S.[4]

2103.1.2 Embodied CO2e disclosure of masonry units.

Language in this section recognizes the complete lack of data around masonry unit products. Recognized in the Clean Future Act as a product on the secondary list of materials, masonry units, are required to submit EPDs to increase the amount of data.[5]

2205.3 Embodied CO2e of steel products.

Language in this proposal recognizes the international dataset available to set targets across multiple steel products. Products with the most data have been targeted at (75%) of international values, eliminating the worst performing products. All structural steel products are required to submit EPDs to increase the amount of data for future updates to model code language. Steel is the second most widely used materials in building construction and a primary contributor to embodied carbon in buildings. The U.S. steel industry is responsible for 104.6 MMT of CO2 emissions annually, a contribution that makes up 2% of total U.S. emissions.[3] Steel destined for the built environment is responsible for 46 MMT of CO2 emissions annually, nearly half of the total annual emissions from the steel industry.[3] Many types of steel products made with different manufacturing techniques are found in buildings. Hot-rolled structural steel is the predominant structural framing material used in building construction, holding 46% of the market share for structural framing materials for nonresidential and multistory residential construction in 2017. [6] Steel reinforcing or "rebar," which is typically embedded in structural concrete, can also be a major use of steel and source of embodied carbon in buildings. A recent case study analysis by RMI shows that simply by specifying rebar products with lower CO2e content, the embodied carbon of a typical commercial construction project can be reduced up to 10%.[2]

2303.8 Embodied CO2e disclosure of wood products.

Language in this section recognizes the complete lack of data and inconsistent consensus on climate-smart wood products. Recognized in the Clean Future Act[5] as a product on the secondary list of materials, wood products regulated in Chapter 23 are required to submit EPDs to increase the amount of data for future updates to model code language. Jurisdictions can revise the percentage of materials subject to the requirements as necessary to meet their own needs.

2403.6 Embodied CO2e disclosure of glass products.

Language in this section recognizes the complete lack of data around flat glass products. Recognized in the Clean Future Act[5] as a product on the secondary list of materials, flat glass are required to submit EPDs to increase the amount of data for future updates to model code language.

Bibliography: [1] Marin County, Carbon Concrete Requirements, Chapter 19.07, November 2021, https://library.municode.com/ca/marin_county/codes/municipal_code?nodeId=TIT19MACOBUCO
[2] Matt Jungclaus, Rebecca Esau, Victor Olgyay, and Audrey Rempher, *Low-Cost, High-Value Opportunities to Reduce Embodied Carbon in Buildings,* RMI, 2021.

[3] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018,* US Environmental Protection Agency, 2020, https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf; and "Manufacturing Energy and Carbon Footprint," US Department of Energy, https://www.energy.gov/sites/prod/files/2018/10/f56/2014_mecs_cement_energy_footprint.pdf.

[4] *2019 U.S. Cement Industry Annual Yearbook,* Portland Cement Association, 2019, https://www.cement.org/morereports/2018-us-cement-industry-annual-yearbook.

[5] *GSA Green Building Advisory Committee Advice Letter: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials by Federal Agencies,* U.S. General Services Administration, February 17 2021, https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/policy/green-building-advisory-committee/advice-letters-and-resolutions

[6] *Structural Steel: An Industry Overview*, American Institute of Steel Construction, August 2018, https://www.aisc.org/globalassets/aisc/publications/white-papers/structural_steel_industry_overview_2018.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The impact of the embodied carbon considerations in code to project teams can be cost-neutral when the requirements are specified and administered efficiently. As described in the code, GWP limits for concrete mixes are set through an evaluation of national EPDs and their GWP values; data available for many regional concrete suppliers indicate that local markets can outperform the national average and is well-positioned to meet the code criteria. The optimizations needed to produce compliant concrete mixes can be achieved primarily by reducing cement in concrete mixes, through strategies like high performance aggregate selection or cement substitution. These interventions can be made without a cost impact if the criteria are effectively communicated to ready-mix suppliers. For projects necessitating a quicked concrete curing time, the code allows for a 130% GWP increase for high, early strength concrete because this concrete often requires additional cement. Low embodied carbon concrete does not require onerous changes to upstream industrial processes.

For steel products, the GWP limits were established using a percentage of the Type III industry-wide EPDs for each product, considering whether the product is directly from the mill or has been fabricated. The energy related to steel product manufacturing dominates the calculated embodied carbon of the final product. Therefore, products manufactured with electricity, over natural gas, and in regions with lower carbon energy grids, will have lower embodied carbon. International steel production's energy is sourced from more extensive coal and natural gas percentages than is found in the U.S., making American-made steel lower in carbon than most steel derived from Asian countries.

A recent case study analysis by RMI shows that simply by specifying concrete products with lower CO2e content, the embodied carbon of a commercial construction project can be reduced up to 33%. Similarly, specifying rebar with lower CO2e content can reduce the embodied carbon of a typical commercial construction project up to 10%. Both of these specifications were indicated to have a cost premium of less than 1%. Additional project-level research has shown a cost savings due to structural material efficiency as by right-sizing structural members, up to a 5% cost savings on structural materials has been achieved.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as means & methods of manufactures are not appropriate for the IBC. (Vote: 13-0)

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 202, SECTION 202 (New), 1903.5, 1903.5.1, TABLE 1903.5.1, 1903.5.2, 1903.5.3 (New), 2103.1.2, 2205.3, 2205.3.1, 2205.3.2, TABLE 2205.3.3, 2303.8, 2403.6, 2205.3.3, ASTM Chapter 35, ISO Chapter 35

Proponents: Webly Bowles, representing New Buildings Institute (webly@newbuildings.org); Kimberly Cheslak, NBI, representing NBI (kim@newbuildings.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

[BS] CONCRETE. Mixture of cementitious material, fine aggregate, coarse aggregate and water, with or without admixture.

CARBON DIOXIDE EQUIVALENT (CO2e). A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO2e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO2). ~~GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2. The following GWP values are used based on a 100-year time horizon: 1 for CO2, 25 for methane (CH4), and 298 for nitrous oxide (N2O).~~

~~**COMMUNITY RENEWABLE ENERGY FACILITY.** A facility that produces energy harvested from *renewable energy resources* and is qualified as a community energy facility under applicable jurisdictional statutes and rules.~~

~~**FLAT GLASS.** A type of glass, initially produced in plane form. Common uses include, but are not limited to, windows, glass doors, and transparent walls. Flat glass is in contrast to container glass, glass fiber (insulation) and optical communication. Flat glass has a higher magnesium oxide and sodium oxide content than container glass and a lower silica, calcium oxide, and aluminum.~~

~~**FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA).** A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a "financial power purchase agreement" and "virtual power purchase agreement."~~

GLOBAL WARMING POTENTIAL (GWP). GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2.

~~**ON-SITE RENEWABLE ENERGY.** Energy from *renewable energy resources* harvested at the building site.~~

~~**PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA).** A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.~~

~~**PLATE GLASS.** See "Flat glass"~~

~~**RENEWABLE ENERGY RESOURCES.** Energy from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.~~

~~**SHEET GLASS.** See "Flat glass"~~

1903.5 Embodied CO2e of concrete ~~materials~~ products. *Concrete* products used in the building project's *primary structural frame*, *secondary structural members*, and foundations shall be in accordance with Sections 1903.5.1, ~~or~~ 1903.5.2, or 1903.5.3.

Exceptions:

1. Precast concrete, shotcrete, or auger cast concrete.
2. ~~*Masonry units* complying with Section 2103.1.2.~~ Projects under 50,000 square feet
3. Projects where the total volume of concrete is less than 50 cubic yards.
4. Projects where the total cost of the *concrete* is less than 5% of the total project value.
5. Projects where no *concrete* suppliers with product-specific environmental product declarations (EPD) for a *concrete* strength are located within 100 miles of the project site~~, where Type III industry-wide EPDs and an inventory of CO2e values for all concrete mixes are provided to the AHJ~~.

1903.5.1 CO2e Limit Method - Mixture. The total CO2e of ~~the~~ 75% of the *concrete* mixes used in the project shall not exceed the value given in Table 1903.5.1 based on the compressive strength of the product. CO2e content shall be documented by a product-specific Type III Environmental Product Declaration (EPD) for each ~~product~~ mix. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

TABLE 1903.5.1
CO2e LIMITS IN MIXTURE

Specified compressive strength f'_c, psi	Maximum kg/m^3(SI)	High-early strength Maximum kg/m^3 (SI)	Lightweight concrete Maximum kg/m^3 (SI)
up to 2499	302	408	578
2500-3499	382	516	578
3500-4499	432	583	626
4500-5499	481	649	675
5500-6499	505	682	N/A
6500 and greater	518	680	N/A

1903.5.2 CO2e Limit Method - Project. Total CO2e ($CO2e_{proj}$) of ~~all~~ 75% of the building project *concrete* ~~placed at the building project~~ shall not exceed the project limit ($CO2e_{allowed}$) determined using Table 1903.5.1 and Equation 1903.5.2 .

Equation 1903.5.2
$CO2e_{proj} < CO2E_{allowed}$

where: $CO2E_{proj} = \Sigma O2E_n v_n$ *and* $CO2E_{allowed} = \Sigma CO2E_{lim} v_n$
and

n = the total number of *concrete* mixtures for the project

$CO2E_n$ = the global warming potential for mixture n per mixture EPD, kg/m^3

$CO2E_{lim}$ = the global warming potential limit for mixture n per Table 1903.5.1, kg/m^3

v_n = the volume of mixture n *concrete* to be placed

1903.5.3 EPD Disclosure. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *concrete* products, based on cost or volume. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21940 and be available in a publicly accessible database.

~~**2103.1.2 Embodied CO2e disclosure of masonry units.** Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *masonry units,* by cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.~~

~~**2205.3 Embodied CO2e of steel products.** Structural steel, hollow steel section, steel plate, and concrete reinforcing steel bar products used in the *building* shall comply with Section 2205.3.1, and one of either 2205.3.2 or 2205.3.3.~~

~~**2205.3.1 EPD Disclosure.** Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of steel products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.~~

~~**2205.3.2 Steel Production.** A minimum of 75% of steel products listed in this section, based on cost, shall be produced in a facility or facilities that comply with one of the following:~~

1. ~~On the date of procurement is independently, or as part of an aggregation of facilities, a Green Power Partner in the United Stated Environmental Protection Agency (U.S. EPA) Green Power Partnership program, or an equivalent renewable power procurement registry as approved by the AHJ.~~
2. ~~Not less than 50% of the energy sourced for production at the facility is a *renewable energy resource* as documented from one or more of the following:~~

   2.1. ~~*On-site renewable energy* system~~

   2.2. ~~Off-site renewable energy system owned by the production facility owner~~

   2.3. ~~*Community renewable energy facility*~~

   2.4. ~~*Physical Renewable Energy PPA*~~

   2.5. ~~*Financial Renewable Energy PPA*~~

~~TABLE 2205.3.3~~

~~CO2e LIMIT PER STEEL PRODUCT~~

~~Steel Product~~	**~~Mill kg CO2e/kg[a]~~**	**~~Fabrication kg CO2e/kg[b]~~**	
~~Structural Steel~~	~~Structural Sections~~	~~0.99~~	~~1.22~~
~~Structural Steel~~	~~Hollow Structural Sections~~	~~1.71~~	~~1.99~~
~~Structural Steel~~	~~Plate~~	~~1.47~~	~~1.73~~
~~Concrete Reinforcing Bars~~	~~0.89~~	~~0.98~~	

~~a. Applies when an EPD declares mill-only material (cradle to mill gate).~~

~~b. Applies when an EPD declares mill material plus U.S. industry average fabrication impacts (cradle to fabricator gate).~~

~~2303.8 Embodied CO2e disclosure of wood products.~~ ~~Environmental Product Declarations (EPD) shall be submitted for 75% of wood products and members, based on cost. Type III EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.~~

~~2403.6 Embodied CO2e disclosure of glass products.~~ ~~Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *flat glass* products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.~~

~~2205.3.3 Steel Product CO2e Limits.~~ ~~A minimum of 75% of steel products, based on cost, shall not exceed the total CO2e values in Table 2205.3.3 based on product type.~~

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

~~C567/C567M-19~~ ~~Standard Test Method for Determining Density of Structural Lightweight Concrete~~

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedure

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and service

Commenter's Reason: This proposal adjusts the initial proposal to consider only concrete products. The applicable concrete has been clarified to being related to the structural system. New exceptions have been added so the requirement only applies to projects for 50,000 square feet, those that use over 50 cubic yards of concrete, or where concrete is over 5% of the total project value.
This proposal does not require concrete products to be manufactured in a specific way. Products can meet the global warming potential (GWP) limits through one of two paths. Both paths allow flexibility in how the GWP limit is achieved. Projects may not achieve the limits in the exact same way since there are many different low-CO2e options available to cement manufacturers, available alternative cementitious materials, and concrete manufacturers' additives, and more, that can support the creation of lower Co2e concrete options.

These revisions provide clarity on the scope and only apply to larger projects.

Bibliography: [1] Low Embodied Carbon Concrete Standards for all GSA Projects, U.S. General Services Administration, 2022.
[2] Buy Clean Buy Fair Washington Project Progress Report, Washington State Commerce Department, 2021.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost impact statement has not changed.

Based on U.S. General Services Administration's answers from a Spring 2022 poll about the cost of low carbon concrete, respondents answered the question, “How does the cost of your company's low embodied carbon concrete compares to that of conventional equivalents?”, with 66% of the respondents stating that low carbon concrete was equal to, or less expensive. [1]

Additionally, Carbon Leadership Forum conducted research to show that when tracking and reducing product GWP values for an office town in Bellevue, Washington, the project was able to reduce the embodied carbon of structural steel and concrete, compared to the baseline at no additional cost. Through collecting EPDs from suppliers and tracking their EPDs and reductions, the team was able to measure and achieve the a 10-35% GWP reduction in the ready mixed concrete for no additional cost. [2]

Public Comment# 3141

Public Comment 2:

IBC: SECTION 202, SECTION 202 (New), 1903.5, 1903.5.1, TABLE 1903.5.1, 1903.5.2, 2103.1.2, 2205.3, 2205.3.3, TABLE 2205.3.3, 2205.3.1, 2205.3.2, 2303.8, 2403.6, ASTM Chapter 35, ISO Chapter 35

Proponents: Webly Bowles, representing New Buildings Institute (webly@newbuildings.org); Kimberly Cheslak, NBI, representing NBI (kim@newbuildings.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

[BS] ~~CONCRETE.~~ ~~Mixture of cementitious material, fine aggregate, coarse aggregate and water, with or without admixture.~~

CARBON DIOXIDE EQUIVALENT (CO2e). A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO2e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO2). ~~GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2. The following GWP values are used based on a 100-year time horizon: 1 for CO2, 25 for methane (CH4), and 298 for nitrous oxide (N2O).~~

<u>**GLOBAL WARMING POTENTIAL (GWP).** An index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2.</u>

~~**COMMUNITY RENEWABLE ENERGY FACILITY.** A facility that produces energy harvested from *renewable energy resources* and is qualified as a community energy facility under applicable jurisdictional statutes and rules.~~

~~**ON-SITE RENEWABLE ENERGY.** Energy from *renewable energy resources* harvested at the building site.~~

~~**PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA).** A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.~~

~~**FLAT GLASS.** A type of glass, initially produced in plane form. Common uses include, but are not limited to, windows, glass doors, and transparent walls. Flat glass is in contrast to container glass, glass fiber (insulation) and optical communication. Flat glass has a higher magnesium oxide and sodium oxide content than container glass and a lower silica, calcium oxide, and aluminum.~~

~~**PLATE GLASS.** See “Flat glass”~~

~~**SHEET GLASS.** See “Flat glass”~~

~~**RENEWABLE ENERGY RESOURCES.** Energy from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.~~

~~**FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPA).** A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project’s renewable generation. Also known as a “financial power purchase agreement” and “virtual power purchase agreement.”~~

~~**1903.5 Embodied CO2e of concrete materials.** *Concrete* products used in the building project shall be in accordance with Sections 1903.5.1 or 1903.5.2.~~

~~**Exceptions:**~~

1. ~~Precast concrete.~~
2. ~~*Masonry units* complying with Section 2103.1.2.~~
3. ~~Projects where no *concrete* suppliers with product-specific environmental product declarations (EPD) for *concrete* are located within 100 miles of the project site, where Type III industry-wide EPDs and an inventory of CO2e values for all concrete mixes are provided to the AHJ.~~

~~**1903.5.1 CO2e Limit Method - Mixture.** The total CO2e of the *concrete* mixes used in the project shall not exceed the value given in Table 1903.5.1 based on the compressive strength of the product. CO2e content shall be documented by a product-specific Type III Environmental Product Declaration (EPD) for each product. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.~~

~~TABLE 1903.5.1~~
~~CO2e LIMITS IN MIXTURE~~

~~**Specified compressive strength f'_c, psi**~~	~~**Maximum kg/m^3(SI)**~~	~~**High-early strength Maximum kg/m^3 (SI)**~~	~~**Lightweight concrete Maximum kg/m^3 (SI)**~~
~~up to 2499~~	~~302~~	~~408~~	~~578~~
2500-3499	382	~~516~~	~~578~~
~~3500-4499~~	~~432~~	~~583~~	~~626~~
~~4500-5499~~	~~481~~	~~649~~	~~675~~
~~5500-6499~~	~~505~~	~~682~~	~~N/A~~
~~6500 and greater~~	~~518~~	~~680~~	~~N/A~~

~~**1903.5.2 CO2e Limit Method - Project.** Total CO2e ($CO2e_{proj}$) of all *concrete* placed at the building project shall not exceed the project limit ($CO2e_{allowed}$) determined using Table 1903.5.1 and Equation 1903.5.2~~

~~**Equation 1903.5.2**~~
~~$CO2e_{proj} < CO2E_{allowed}$~~

~~where: $CO2E_{proj} = \Sigma O2E_n v_n$ *and* $CO2E_{allowed} = \Sigma CO2E_{lim} v_n$~~
~~*and*~~

~~*n* = the total number of *concrete* mixtures for the project~~

~~$CO2E_n$ = the global warming potential for mixture n per mixture EPD, kg/m^3~~

~~$CO2E_{lim}$ = the global warming potential limit for mixture n per Table 1903.5.1, kg/m^3~~

~~v_n = the volume of mixture n *concrete* to be placed~~

~~**2103.1.2 Embodied CO2e disclosure of masonry units.** Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *masonry units,* by cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.~~

2205.3 Embodied CO2e of steel products. Structural steel, hollow steel section, steel plate, and concrete reinforcing steel bar products used in the building's *primary structural frame*, *secondary structural members*, and foundations shall comply with Section 2205.3.1 or~~, and one of either~~ 2205.3.2~~ or 2205.3.3~~.
Exceptions:

1. Projects under 50,000 square feet
2. Projects where the total cost of the steel is less than 5% of the total project value.

2205.3.~~3~~ 1 ~~Steel Product~~ CO2e Limit~~s~~ Method. The total CO2e ~~A minimum~~ of 75% of the steel products used the project ~~, based on cost,~~ shall not exceed the value given ~~total CO2e values~~ in Table 2205.3.~~3~~ 1 based on the steel product ~~type~~. Co2e content shall be documented by a product-specific Type III Environmental Product Declaration (EPD) for each product. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

TABLE 2205.3.3
CO2e LIMIT PER STEEL PRODUCT

Steel Product	**Mill kg CO2e/kg[a]**	**Fabrication kg CO2e/kg[b]**
Structural Steel: Structural Sections	~~0.99~~ 1.75	~~1.22~~ 2.14
Structural Steel: Hollow Structural Sections	~~1.71~~ 2.99	~~1.99~~ 3.48
Structural Steel: Plate	~~1.47~~ 2.57	~~1.73~~ 3.03
Concrete Reinforcing Bars	0.89	0.98

a. Applies when an EPD declares mill-only material (cradle to mill gate).

b. Applies when an EPD declares mill material plus U.S. industry average fabrication impacts (cradle to fabricator gate).

2205.3.~~1~~ 2 EPD Disclosure. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of steel products, based on cost or weight. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

~~**2205.3.2 Steel Production.** A minimum of 75% of steel products listed in this section, based on cost, shall be produced in a facility or facilities that comply with one of the following:~~

1. ~~On the date of procurement is independently, or as part of an aggregation of facilities, a Green Power Partner in the United Stated Environmental Protection Agency (U.S. EPA) Green Power Partnership program, or an equivalent renewable power procurement registry as approved by the AHJ.~~
2. ~~Not less than 50% of the energy sourced for production at the facility is a *renewable energy resource* as documented from one or more of the following:~~

   ~~2.1. *On-site renewable energy* system~~

   ~~2.2. Off-site renewable energy system owned by the production facility owner~~

   ~~2.3. *Community renewable energy facility*~~

   ~~2.4. *Physical Renewable Energy PPA*~~

   ~~2.5. *Financial Renewable Energy PPA*~~

~~**2303.8 Embodied CO2e disclosure of wood products.** Environmental Product Declarations (EPD) shall be submitted for 75% of wood products and members, based on cost. Type III EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.~~

~~**2403.6 Embodied CO2e disclosure of glass products.** Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *flat glass* products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.~~

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

~~C567/C567M-19~~ ~~Standard Test Method for Determining Density of Structural Lightweight Concrete~~

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedure

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and service

Commenter's Reason: This public comment adjusts the initial proposal to consider only steel products. The steel has been defined as that which relates to the primary structural frame, secondary structural members, and foundations. New exceptions have been added so the requirement only applies to projects over 50,000 square feet, those that use steel which costs more than 5% of the total project value. Additionally, the GWP limits have been updated to be 175% of the industry average, instead of being the industry average values.

The edits also remove the option to comply through procuring steel from manufacturers with renewable energy. The only way to comply is by meeting the GWP limits for each structural steel product listed in the table. The proposal does not require steel products to be manufactured in a specific way.

Bibliography: [1] Buy Clean Buy Fair Washington Project Progress Report, Washington State Commerce Department, 2021.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost impact statement has not changed.

Additionally, Carbon Leadership Forum conducted research to show that when tracking and reducing product GWP values for an office town in Bellevue, Washington, the project was able to reduce the embodied carbon of structural steel and concrete, compared to the baseline at no additional cost. Through collecting EPDs from suppliers and tracking their EPDs and reductions, the team was able to measure and achieve a GWP reduction no additional cost. [1]

Public Comment# 3288

Public Comment 3:

IBC: 1903.5, 2103.1.2, 2205.3, 2303.8, 2403.6, SECTION 202, ISO Chapter 35

Proponents: Anish Tilak, representing RMI requests As Modified by Public Comment

Replace as follows:

2021 International Building Code

1903.5 Embodied CO2e disclosure of concrete materials. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of concrete products, based on cost or volume. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

Exceptions:

1. Precast concrete.
2. *Masonry units* complying with Section 2103.1.2.
3. Projects where no *concrete* suppliers with product-specific environmental product declarations (EPD) for *concrete* are located within 100 miles of the project site.

2103.1.2 Embodied CO2e disclosure of masonry units. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of *masonry units*, by cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

2205.3 Embodied CO2e disclosure of steel products. Product-specific Type III Environmental Product Declarations (EPD) shall be submitted for 75% of steel products, based on cost or weight. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

2303.8 Embodied CO2e disclosure of wood products. Environmental Product Declarations (EPD) shall be submitted for 75% of wood products and members, based on cost. Type III EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

2403.6 Embodied CO2e disclosure of glass products. Type III Environmental Product Declarations (EPD)
shall be submitted for 75% of *flat glass* products, based on cost. EPDs used for compliance with this section shall be certified as complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930 and be available in a publicly accessible database.

[BS] CONCRETE. Mixture of cementitious material, fine aggregate, coarse aggregate and water, with or without admixture.

CARBON DIOXIDE EQUIVALENT (CO2e). A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO2e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO2). GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO2. The following GWP values are used based on a 100-year time horizon: 1 for CO2, 25 for methane (CH4), and 298 for nitrous oxide (N2O).

FLAT GLASS. A type of glass, initially produced in plane form. Common uses include, but are not limited to, windows, glass doors, and transparent walls. Flat glass is in contrast to container glass, glass fiber (insulation) and optical communication. Flat glass has a higher magnesium oxide and sodium oxide content than container glass and a lower silica, calcium oxide, and aluminum.

PLATE GLASS. See "Flat glass"

SHEET GLASS. See "Flat glass"

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 14025:2006	Environmental labels and declarations — Type III environmental declarations — Principles and procedure

ISO

International Organization for Standardization
Chemin de Blandonnet 8 CP 401 1214 Vernier
Geneva, Switzerland

ISO 21930:2017	Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and service

Commenter's Reason: The alternative language presented in this public comment addresses concerns that, in the near term, building project teams may not have sufficient choice in selecting products that comply with global warming potential (GWP) standards. This alternative proposes a standard for product-specific Type III Environmental Product Declaration (EPD) reporting ONLY, by which 75% of installed building materials in key product categories shall include cradle-to-gate lifecycle environmental impact assessments. This reporting increases transparency for builders, providing additional product data properties to enable more informed decision-making and product selection.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no impact on construction cost, as demonstrated in the original proposal

Public Comment# 3314

S182-22

IBC: 2103.2.4, TMS Chapter 35 (New)

Proposed Change as Submitted

Proponents: Phillip Samblanet, representing The Masonry Society (psamblanet@masonrysociety.org); Jason Thompson, representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

2021 International Building Code

Revise as follows:

2103.2.4 Mortar for adhered masonry veneer. *Mortar* for use with *adhered masonry veneer* shall conform to Section 13.3 of TMS 402.~~ASTM C270 for Type N or S, or shall comply with ANSI A118.4 for latex-modified Portland cement *mortar*.~~

Add new standard(s) as follows:

TMS

The Masonry Society
105 South Sunset Street, Suite Q
Longmont, CO 80501-6172

402-22 Building Code Requirements for Masonry Structures

Reason: Provisions for adhered veneer have been extensively discussed and updated in the 2022 TMS 402 to be more rationally based using a minimum mortar/unit bond strength value. This change updates the mortar requirements to comply with those provisions. Setting bed mortars are required by TMS 402/602-22 to be latex-modified mortars complying with ANSI A118.4 or A118.15 due to their increased bond strength. Setting bed mortars meeting ASTM C270 Type N or S are only permitted when testing is conducted on the specific mortar/unit combination to be used in construction.

Cost Impact: The code change proposal will increase the cost of construction
This change updates requirements for mortar for adhered masonry veneer. In most cases, because these mortars are currently used and required, there is no increase in the cost of construction. For some construction, there could be a minor increase in the cost of mortar used for these systems to achieve better performance.

Staff Analysis: The proposal is referencing an updated version of an existing referenced standard. Therefore the updated version is considered an new standard. A review of the standard proposed for inclusion in the code, TMS 402-22 Building Code Requirements for Masonry Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S182-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as TMS 402-22 covers the requirements for mortar. (Vote: 13-0)

S182-22

Individual Consideration Agenda

Public Comment 1:

Proponents: CP28 administration

Commenter's Reason: The administration of ICC Council Policy 28 (CP28) is not taking a position on this code change. This public comment is being submitted to bring a procedural requirement to the attention of the ICC voting membership. In accordance with Section 3.6.3.1.1 of ICC Council Policy 28 (partially reproduced below), the new referenced standard TMS 402-22 must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

(CP28) 3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
N/A

Public Comment# 3537

S183-22

IBC: 2107.2, 2107.2.1, 2107.3, 2108.2, 2108.3, TMS Chapter 35 (New)

Proposed Change as Submitted

Proponents: Phillip Samblanet, representing The Masonry Society (psamblanet@masonrysociety.org); Jason Thompson, representing Masonry Alliance for Codes and Standards (jthompson@ncma.org)

2021 International Building Code

Revise as follows:

2107.2 TMS 402, Section ~~61611~~ 6.1.7.1, lap splices. As an alternative to Section ~~6.1.6.1.1~~ 6.1.7.1, it shall be permitted to design lap splices in accordance with Section 2107.2.1.

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be:

$$l_d = 0.002 d_b f_s$$

For SI:

$$l_d = 0.29 d_b f_s$$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters.

~~where :~~

~~d_b = Diameter of reinforcement, inches (mm).~~

~~f_s = Computed stress in reinforcement due to design loads, psi (MPa).~~

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of ~~the allowable steel tension stress,~~ F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107.3 TMS 402, Section ~~6161~~ 6.1.7, splices of reinforcement. Add to~~Modify~~ Section ~~6.1.6.1~~ 6.1.7 as follows:

- ~~6.1.6.1~~ 6.1.7– Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section ~~6.1.6.1.3~~ 6.1.7.2.

2108.2 TMS 402, Section ~~61511~~ 6.1.6, development. ~~Modify~~ Add a ~~the~~ second paragraph ~~of~~ Section 6.1.6.3.1~~6.1.5.1.1~~ as follows:
The required development length of reinforcement ~~shall be determined by Equation (6-1), but shall be not less than 12 inches (305 mm) and~~ need not be greater than 72 d_b.

2108.3 TMS 402, Section 61611, splices. ~~Modify~~ Add to Sections ~~6.1.6.1.2 and 6.1.6.1.3~~ 6.1.7.2.1 and 6.1.7.3.1 as follows:

- ~~6.1.6.1.2~~ 6.1.7.3.1 – ~~A welded splice shall have the bars butted and welded to develop not less than 125 percent of the yield strength, f_y, of the bar in tension or compression, as required. Welded splices shall be of ASTM A706 steel reinforcement.~~ Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.
- ~~6.1.6.1.3~~ 6.1.7.2.1 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special *reinforced masonry* shear walls. Type 2 mechanical splices are permitted in any location within a member.

Add new standard(s) as follows:

TMS

The Masonry Society
105 South Sunset Street, Suite Q
Longmont, CO 80501-6172

402-22 Building Code Requirements for Masonry Structures

Reason: The cited references have been moved. In addition, some of the requirements shown to be deleted are now included in TMS 402, and are thus no longer required in the IBC directly (as they would be redundant). No technical changes have been proposed in this change. The intent is just to update references and to remove redundancy.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change simply deletes redundant requirements and updates references. As such, there is no impact on construction costs.

Staff Analysis: The proposal is referencing an updated version of an existing referenced standard. Therefore the updated version is considered an new standard. A review of the standard proposed for inclusion in the code, TMS 402-22 Building Code Requirements for Masonry Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S183-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal brings needed clarity and removes redundancy items for the IBC. (Vote: 13-0)

S183-22

Individual Consideration Agenda

Public Comment 1:

Proponents: CP28 administration

Commenter's Reason: The administration of ICC Council Policy 28 (CP28) is not taking a position on this code change. This public comment is being submitted to bring a procedural requirement to the attention of the ICC voting membership. In accordance with Section 3.6.3.1.1 of ICC Council Policy 28 (partially reproduced below), the new referenced standard TMS 402-22 must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.
(CP28) 3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
N/A

Public Comment# 3538

S185-22

IBC: 2109.1.1

Proposed Change as Submitted

Proponents: John-Jozef Proczka, representing Self (john-jozef.proczka@phoenix.gov)

2021 International Building Code

Revise as follows:

2109.1.1 Limitations. The use of empirical design of adobe masonry shall be limited as noted in Section A.1.2 of TMS 402. In buildings that exceed one or more of the limitations of Section A.1.2 of TMS 402, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2 or the foundation wall provisions of Section 1807.1.5.
Section ~~A.1.2.2~~ A.1.2.3 of TMS 402 shall be modified as follows:

- ~~A.1.2.2~~ A.1.2.3 – *Wind*. Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where V_{asd} as determined in accordance with Section 1609.3.1 of the *International Building Code* exceeds 110 mph.

Reason: This code change proposal corrects what appears to be a longstanding typographical error. As the code currently stands the seismic section of TMS 402 Appendix A is eliminated and states wind limitations twice in A1.2.2 and A1.2.3.
There are those who assume this is not a typographical error, but an attempt to completely undo the TMS 402 seismic requirements of Appendix A in the IBC. This is not the case. TMS 402 is specific about what SDCs are allowed and in what capacities.

Cost Impact: The code change proposal will increase the cost of construction
Depending on one's current interpretation of the typographical error this will either have no impact or will restrict adobe masonry to only certain situations in certain SDCs.

S185-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal is no longer needed as adobe has been removed from TMS 402. (Vote: 13-0)

S185-22

Individual Consideration Agenda

Public Comment 1:

IBC: 2109.1.1

Proponents: Ben Loescher, representing The Earthbuilders' Guild (bloescher@lmarchitectsinc.com); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Anthony Dente, representing Verdant Structural Engineers (anthony@verdantstructural.com) requests As Submitted

Commenter's Reason: This Proposal was not approved in the Committee Action Hearings after Proposal S144-22 was approved. Reconsideration is necessitated by Public Comment related to that item.

The current language of Section 2109.1.1 includes what appears to be a longstanding typographical error which incorrectly indicates A1.2.2 for provisions related to Wind; the correct citation for Wind in TMS 402 Appendix A is A1.2.3; A1.2.2 is the reference for Seismic. Without this correction, the reader may incorrectly conclude that Empirical Design of Adobe Masonry is permitted in highly seismic areas (Seismic Design D, E & F) where that design approach is inappropriate.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The this code change will clarify the restriction on the use of empirically designed adobe masonry to specific lower seismic risk areas, and as a

result may increase the cost of construction.

Public Comment# 3169

S187-22

IBC: CHAPTER 22, SECTION 2201, 2201.1, 2201.2 (New), 2201.3 (New), 2201.4 (New), 2201.5 (New), SECTION 2202, 2202.1, SECTION 2203, 2203.1, SECTION 2204, 2204.1, 2204.2, 2204.3, SECTION 2205, 2205.1, 2205.2, 2205.2.1, 2205.2.1.1, 2205.2.1.2, 2205.2.2, SECTION 2206, 2206.1, 2206.2, 2206.2.1, 2203 (New), 2203.1 (New), SECTION 2210, 2210.1, 2210.2, 2204.2.1 (New), 2204.2.2 (New), 2205 (New), 2205.1 (New), SECTION 2211, 2211.1, 2211.1.1, 2211.1.1.1, 2211.1.1.2, 2211.1.2, 2211.1.3, 2211.1.3.1, 2211.1.3.2, 2211.1.3.3, 2211.2, 2207 (New), 2210.1.1, 2210.1.1.1, 2210.1.1.2, 2210.1.1.3, SECTION 2207, 2207.1, 2207.1.1, 2207.2, 2207.3, 2207.4, 2207.5, SECTION 2209, 2209.1, 2209.2, 2209.3, SECTION 2208, 2208.1, AISC Chapter 35 (New), AISI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Jon-Paul Cardin, representing American Iron and Steel Institute (jcardin@steel.org)

2021 International Building Code

CHAPTER 22
STEEL

SECTION 2201
GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

Add new text as follows:

2201.2 Identification. Identification of steel members shall be in accordance with the applicable reference standards within this chapter. Other steel furnished for structural load-carrying purposes shall be identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

2201.3 Protection. The protection of steel members shall be in accordance with the applicable reference standards within this chapter.

2201.4 Connections. The design and installation of steel connections shall be in accordance with the applicable reference standards within this chapter. For *special inspection* of welding or installation of high-strength bolts, see Section 1705.2.

2201.5 Anchor Rods. Anchor rods shall be set in accordance with the *approved construction documents.* The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

Delete without substitution:

~~SECTION 2202~~
~~IDENTIFICATION OF STEEL FOR STRUCTURAL PURPOSES~~

~~**2202.1 General.** Identification of *structural steel elements* shall be in accordance with AISC 360. Identification of cold-formed steel members shall be in accordance with AISI S100. Identification of cold-formed steel *light-frame construction* shall also comply with the requirements contained in AISI S240 or AISI S220, as applicable. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.~~

~~SECTION 2203~~
~~PROTECTION OF STEEL FOR STRUCTURAL PURPOSES~~

~~**2203.1 General.** Painting of *structural steel elements* shall be in accordance with AISC 360. Painting of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200. Individual structural members and assembled panels of *cold-formed steel construction* shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel *light-frame construction* shall be in accordance with AISI S240 or AISI S220, as applicable.~~

~~SECTION 2204~~
~~CONNECTIONS~~

~~**2204.1 Welding.** The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in Sections 2205, 2206, 2207, 2208, 2210 and 2211. For *special inspection* of welding, see Section 1705.2.~~

~~**2204.2 Bolting.** The design, installation and inspection of bolts shall be in accordance with the requirements of Sections 2205, 2206, 2207, 2210 and~~

~~2211. For *special inspection* of the installation of high-strength bolts, see Section 1705.2.~~

~~**2204.3 Anchor rods.** Anchor rods shall be set in accordance with the *approved construction documents*. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts but shall not be greater than the length of the threads on the bolts.~~

Revise as follows:

SECTION ~~2205~~ 2202
STRUCTURAL STEEL AND COMPOSITE STRUCTURAL STEEL AND CONCRETE

~~2205.1~~ 2202.1 General. The design, fabrication and erection of *structural steel elements* and composite structural steel and concrete elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

~~2205.2~~ 2202.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section ~~2205.2.1~~ 2202.2.1 or ~~2205.2.2~~ 2202.2.2, as applicable.

~~2205.2.1~~ 2202.2.1 Structural steel seismic force-resisting systems and composite structural steel and concrete seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel *seismic force-resisting systems* and composite structural steel and concrete *seismic force-resisting systems* shall be in accordance with the provisions of Section ~~2205.2.1.1~~ 2202.2.1.1 or ~~2205.2.1.2~~ 2202.2.1.2, as applicable.

~~2205.2.1.1~~ 2202.2.1.1 Seismic Design Category B or C. Structures assigned to *Seismic Design Category* B or C shall be of any construction permitted in Section ~~2205~~ 2202. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1, is used for the design of structures assigned to *Seismic Design Category* B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341. Beam-to-column moment connections in structural steel special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

> **Exception:** The response modification coefficient, *R*, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for structural steel systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

~~2205.2.1.2~~ 2202.2.1.2 Seismic Design Category D, E or F. Structures assigned to *Seismic Design Category* D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1. Beam-to-column moment connections in structural steel special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

~~2205.2.2~~ 2202.2.2 Structural steel elements. The design, detailing, fabrication and erection of *structural steel elements* in *seismic force-resisting systems* other than those covered in Section ~~2205.2.1~~ 2202.2.1, including struts, *collectors*, chords and foundation elements, shall be in accordance with AISC 341 where either of the following applies:

1. The structure is assigned to *Seismic Design Category* D, E or F, except as permitted in ASCE 7, Table 15.4-1.
2. A response modification coefficient, R, greater than 3 in accordance with ASCE 7, Table 12.2-1, is used for the design of the structure assigned to *Seismic Design Category* B or C.

Delete without substitution:

~~SECTION 2206~~
~~COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES~~

~~**2206.1 General.** Systems of *structural steel elements* acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.~~

~~**2206.2 Seismic design.** Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206.2.1.~~

~~**2206.2.1 Seismic requirements for composite structural steel and concrete construction.** Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1, is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341.~~

Add new text as follows:

2203
STRUCTURAL STAINLESS STEEL

2203.1 General. The design, fabrication, and erection of austenitic and duplex structural stainless steel shall be in accordance with AISC 370.

Revise as follows:

SECTION ~~2210~~ 2204
COLD-FORMED STEEL

~~2210.1~~ 2204.1 General. The design of cold-formed carbon and low-alloy steel structural members not covered in Sections 2206 through 2209 of this chapter shall be in accordance with AISI S100. ~~The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel *light-frame construction* shall comply with Section 2211.~~ The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310 as applicable. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section ~~2210.2~~ 2204.2.

~~2210.2~~ 2204.2 Seismic design ~~requirements for cold-formed steel structures~~. The design and detailing of cold-formed steel seismic force-resisting systems shall be in accordance with Section 2204.2.1 and 2204.2.2 as applicable.~~Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ASCE 8, or, for cold-formed steel special bolted moment frames, AISI S400.~~

Add new text as follows:

2204.2.1 CFS Special Bolted Moment Frames. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel special bolted moment frames, the structures shall be designed and detailed in accordance with the requirements of AISI S400.

2204.2.2 Cold-formed steel seismic force resisting systems. The response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISI S100 and need not be designed and detailed in accordance with AISI S400.

2205
COLD-FORMED STAINLESS STEEL

2205.1 General. The design of cold-formed stainless steel structural members shall be in accordance with ASCE 8.

Revise as follows:

SECTION ~~2211~~ 2206
COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

~~2211.1~~ 2206.1 Structural framing systems. For cold-formed steel *light-frame construction*, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections ~~2211.1.1~~ 2206.1.1 through ~~2211.1.3~~ 2206.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

~~2211.1.1~~ 2206.1.1 Seismic design ~~requirements for cold-formed steel structural systems~~. The design of cold-formed steel *light-frame construction* to resist seismic forces shall be in accordance with the provisions of Section ~~2211.1.1.1~~ 2206.1.1.1 or ~~2211.1.1.2~~ 2206.1.1.2, as applicable.

~~2211.1.1.1~~ 2206.1.1.1 Seismic Design Categories B and C. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel *light-frame construction* assigned to *Seismic Design Category* B or C, the *seismic force-resisting system* shall be designed and detailed in accordance with the requirements of AISI S400.

> **Exception:** The response modification coefficient, *R*, designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISI S240 and need not be designed and detailed in accordance with AISI S400

~~2211.1.1.2~~ 2206.1.1.2 Seismic Design Categories D through F. In cold-formed steel *light-frame construction* assigned to *Seismic Design Category* D, E or F, the *seismic force-resisting system* shall be designed and detailed in accordance with AISI S400.

~~2211.1.2~~ 2206.1.2 Prescriptive framing. Detached one- and two-family *dwellings* and *townhouses*, less than or equal to three *stories above grade plane*, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

~~2211.1.3~~ 2206.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections ~~2211.1.3.1~~ 2206.1.3.1. through ~~2211.1.3.3~~ 2206.1.3.3.

~~2211.1.3.1~~ 2206.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent *individual truss member* restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing.

~~2211.1.3.2~~ 2206.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a *registered design professional* for the design of the temporary installation restraint/bracing and the permanent *individual truss member* restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. *Special inspection* of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

~~2211.1.3.3~~ 2206.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704.2.5 and 1705.2, as applicable.

~~2211.2~~ 2206.2 Nonstructural framing systems ~~members~~. For cold-formed steel *light-frame construction*, the design and installation of nonstructural members and connections shall be in accordance with AISI S220.

Add new text as follows:

2207
STEEL DECK

Revise as follows:

~~2210.1.1~~ 2207.1 General ~~Steel decks~~. The design and construction of cold-formed steel decks shall be in accordance with this section. The design of cold-formed steel diaphragms shall be in accordance with additional provisions of AISI S310 as applicable.

~~2210.1.1.1~~ 2207.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

~~2210.1.1.2~~ 2207.1.2 Steel roof deck. Steel *roof decks* shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0.

~~2210.1.1.3~~ 2207.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

SECTION ~~2207~~ 2208
STEEL JOISTS

~~2207.1~~ 2208.1 General. The design, manufacture and use of open-web *steel joists* and joist girders shall be in accordance with either SJI 100 or SJI 200, as applicable.

~~2207.1.1~~ 2208.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section ~~2205.2~~ 2202.2 or ~~2211.1.1~~ 2206.1.1.

~~2207.2~~ 2208.2 Design. The *registered design professional* shall indicate on the *construction documents* the *steel joist* and *steel joist* girder designations from ~~the specifications listed in Section 2207.1~~ SJI 100 or SJI 200; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~, bridging termination connections and bearing connection design to resist uplift and lateral *loads*. These documents shall indicate special requirements as follows:

1. Special *loads* including:
    1.1. Concentrated *loads*.
    1.2. Nonuniform *loads*.
    1.3. Net uplift *loads*.
    1.4. Axial *loads*.
    1.5. End moments.
    1.6. Connection forces.

2. Special considerations including:

    2.1. Profiles for joist and joist girder configurations that differ from those defined by ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~.

    2.2. Oversized or other nonstandard web openings.

    2.3. Extended ends.

3. Live and total *load* deflection criteria for joists and joist girder configurations that differ from those defined by ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~.

~~2207.3~~ 2208.3 Calculations. The *steel joist* and joist girder manufacturer shall design the *steel joists* and *steel joist* girders in accordance with ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~ to support the *load* requirements of Section ~~2207.2~~ 2208.2. The *registered design professional* shall be permitted to require submission of the *steel joist* and joist girder calculations as prepared by a *registered design professional* responsible for the product design. Where requested by the *registered design professional*, the *steel joist* manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's *registered design professional*. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~, such as cantilevered conditions and net uplift.
2. Connection design for:

    2.1. Connections that differ from ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~, such as flush-framed or framed connections.

    2.2. Field splices.

    2.3. Joist headers.

~~2207.4~~ 2208.4 Steel joist drawings. *Steel joist* placement plans shall be provided to show the *steel joist* products as specified on the *approved construction documents* and are to be utilized for field installation in accordance with specific project requirements as stated in Section ~~2207.2~~ 2208.2. *Steel joist* placement plans shall include, at a minimum, the following:

1. Listing of applicable *loads* as stated in Section ~~2207~~ 2208.2 and used in the design of the *steel joists* and joist girders as specified in the *approved construction documents*.
2. Profiles for joist and joist girder configurations that differ from those defined by ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~.
3. Connection requirements for:

    3.1. Joist supports.

    3.2. Joist girder supports.

    3.3. Field splices.

    3.4. Bridging attachments.

4. Live and total *load* deflection criteria for joists and joist girder configurations that differ from those defined by ~~the~~ SJI 100 or SJI 200~~specifications listed in Section 2207.1~~.
5. Size, location and connections for bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's *registered design professional*.

~~2207.5~~ 2208.5 Certification. At completion of manufacture, the *steel joist* manufacturer shall submit a *certificate of compliance* to the owner or the owner's authorized agent for submittal to the *building official* as specified in Section 1704.5 stating that work was performed in accordance with *approved construction documents* and with SJI 100 or SJI 200, as applicable ~~specifications listed in Section 2207.1~~.

SECTION 2209
STEEL STORAGE RACKS

Revise as follows:

2209.1 ~~Steel storage racks~~ General. The design, testing and utilization of steel *storage racks* made of cold-formed or hot-rolled steel structural members shall be in accordance with ~~RMI~~ ANSI/MH 16.1. The design testing, and utilization of steel cantilevered *storage racks* made of cold-formed or hot-rolled steel structural members shall be in accordance with ANSI/MH 16.3.~~Where required by ASCE 7, the seismic design of steel *storage racks* shall be in accordance with Section 15.5.3 of ASCE 7.~~

2209.2 ~~Steel cantilevered storage racks~~ Seismic design. ~~The design, testing and utilization of steel cantilevered *storage racks* made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3.~~ Where required by ASCE 7, the seismic design of steel *storage racks* and cantilevered steel *storage racks* shall be in accordance with Section 15.5.3 of ASCE 7.

2209.3 Certification. For ~~rack~~ steel storage racks ~~structures~~ that are 8 feet (2438 mm) in height or greater to the top *load* level and assigned to *Seismic Design Category* D, E, or F at completion of the *storage rack* installation, a *certificate of compliance* shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

SECTION ~~2208~~ 22010
STEEL CABLE STRUCTURES

~~2208.1~~ 2210.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

Add new standard(s) as follows:

AISC

American Institute of Steel
130 East Randolph Street, Suite 2000
Chicago, IL 60601-6219

ANSI/AISC 370-21	Specification for Structural Stainless Steel Buildings

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001

S310-20 w/S1-22	North American Standard for the Design of Steel Deck Diaphragms, 2020 Edition, with Supplement 1, 2022 Edition

Reason: This code change proposal is intended to be an editorial reorganization of IBC Chapter 22 for the purpose of providing better flow, usability, and clarification of steel provisions in the building code. The steel provisions within Chapter 22 of the IBC have been pieced together as they have been developed over the life of the document. This process has resulted in provisions that are technically accurate, but can seem disorganization and confusing from the perspective of the user. The following reasoning is provided for the revisions proposed in each section of this document:
Section 2201: I am proposing to include existing sections on Identification (2202), Protection of Steel for Structural Purposes (2203), and Connections (2204) as subsections under General Section 2201. Each of the existing sections (2202, 2203, 2204) simply serve as pointers to the other product specific sections, and in turn reference standards, within Chapter 22. I have retained the concept of addressing these topics through the applicable reference standards and any additional provisions on each topic. This proposed revision simply consolidates the language to provide a more concise path under the General steel section.

Section 2202: I am proposing to combine the existing Structural Steel (Section 2205) and Composite Structural Steel and Concrete Structures (2206) sections into one section (2202). Both AISC 360 and AISC 341 (referenced in Sections 2205 and 2206) contain the provisions for both Structural Steel and Composite Structural Steel and Concrete as well as the necessary references to ACI 318. The proposal to combine the two sections simply eliminates unnecessary duplication while maintaining the necessary provisions.

Section 2203: This section introduces a new section on Structural Stainless Steel and the new AISC 370 - *Specification for Structural Stainless Steel Buildings*. I am proposing this section, and reference standard, in this proposal primarily for purposes of coordination with respect to section numbering. I am proposing to add these provisions to directly follow those of structural steel as a logical flow of the chapter. This standard was developed as a consensus document using ANSI-accredited procedures to provide a uniform practice in the design of structural stainless steel-framed buildings and other structures.

The AISC 370 Specification is available for free download at www.aisc.org/publications/steel-standards/

Section 2204: These proposed revisions are intended to clarify when to use AISI S100 – *North American Specification for the Design of Cold-Formed Steel Structural Members*. The following cold-formed steel product design standards are developed based on the applicable provisions of AISI S100: AISI framing standards (AISI S220, S240, S400), Steel Deck Institute, Steel Joist Institute, Steel Rack Institute (for cold-formed racks). It is the intention that the product design standards are the primary resource for the design of these specific systems. In lieu of provisions within the product specific design standards, AISI S100 provisions are permitted to be used for the design of applicable cold-formed steel members or systems. The proposed language clarifies that the design standards referenced in the following product specific sections are to be used for the design of those members and systems.

Section 2204.2 also provides clarification regarding the design of cold-formed steel seismic force resisting systems not covered in the following sections.

Section 2205: This section splits the cold-formed stainless-steel provisions into its own section as it references a separate ASCE 8 Standard for the design. The ASCE 8 standard was previously referenced under the existing cold-formed steel section (2210).

Section 2206: This section on cold-formed steel light-framed construction remains essentially unchanged with some minor reference section renumbering.

Section 2207: This section follows the format of the rest of Chapter 22 by splitting out the steel deck provisions into its own section as the Steel Deck Institute develops a series of design standards specific to the design and detailing of steel deck members and systems. These provisions were previously referenced under the existing cold-formed steel section (2210).

Section 2208: This section on steel joists remains essentially unchanged with some minor reference section renumbering.

Section 2209: I have proposed minor reformatting revisions to this section on steel storage racks. To coordinate with the format of the other sections, I am proposing to have the subsections categorized as “general design provisions” and “seismic design provisions” as opposed to categorized by product. The technical content of the provisions remain unchanged.

Section 2210: This section on steel cable structures remains unchanged with just renumbering of the section.

This proposal is a coordinated effort with the American Institute for Steel Construction (AISC), Steel Joist Institute (SJI), Steel Deck Institute (SDI), Metal Building Manufacturers Association (MBMA), Rack Manufacturers Association (RMA), and the steel framing industry. There are concurrent code change proposals submitted on behalf of MBMA, to add Metal Building Systems, and SDI, to revise Section 2207, that have been coordinated with AISI and this proposal. Those proposals are intended to work jointly with, and do not conflict with, this proposal.

Bibliography: AISC, “ANSI/AISC 370 - Specification for Structural Stainless Steel Buildings", American Institute of Steel Construction, Chicago, IL, 2021 edition.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal is intended to be an editorial reorganization of existing provisions, and will not impact cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, AISC ANSI/AISC 370-21 Specification for Structural Stainless Steel Buildings, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.
A review of the standard proposed for inclusion in the code, AISI S310-20 w/S1-22 North American Standard for the Design of Steel Deck Diaphragms, 2020 Edition, with Supplement 1, 2022 Edition, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S187-22

Public Hearing Results

This proposal includes unpublished errata

SECTION ~~22010~~ 2210

STEEL CABLE STRUCTURES

Committee Action: **As Modified**

Committee Modification:

2201.5 Anchor Rods. Anchor rods shall be set in accordance with the *approved construction documents.* The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threaded portion of ~~threads on~~ the bolts.

Committee Reason: Approved as modified as the proposal reorganizes the sections for improved flow. The committee noted that the addition of AISC 370-21 added a needed standard for structural stainless steel buildings. The modification provides a clarification of the length of the threaded portion of the bolt in section 2201.5. (Vote: 13-0)

Individual Consideration Agenda

Public Comment 1:

Proponents: CP28 administration

Commenter's Reason: The administration of ICC Council Policy 28 (CP28) is not taking a position on this code change. This public comment is being submitted to bring a procedural requirement to the attention of the ICC voting membership. In accordance with Section 3.6.3.1.1 of ICC Council Policy 28 (partially reproduced below), the new referenced standard ANSI S310-20 w/S1-22 must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.
(CP28) 3.6.3.1.1 Proposed New Standards. In order for a new standard to be considered for reference by the Code, such standard shall be submitted in at least a consensus draft form in accordance with Section 3.4. If the proposed new standard is not submitted in at least consensus draft form, the code change proposal shall be considered incomplete and shall not be processed. The code change proposal shall be considered at the Committee Action Hearing by the applicable code development committee responsible for the corresponding proposed changes to the code text. If the committee action at the Committee Action Hearing is either As Submitted or As Modified and the standard is not completed, the code change proposal shall automatically be placed on the Public Comment Agenda with the recommendation stating that in order for the public comment to be considered, the new standard shall be completed and readily available prior to the Public Comment Hearing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
N/A

Public Comment# 3539

S192-22

IBC: 2209.4 (New), MHI Chapter 35 (New)

Proposed Change as Submitted

Proponents: Paul Armstrong, MHI, representing MHI (paul@7arms.com)

2021 International Building Code

Add new text as follows:

2209.4 Material handling stairs, ladders and guards. The design and installation of stairs, ladders and guarding serving material handling structures shall be in accordance with ANSI/MH 32.1.

Add new standard(s) as follows:

MHI

Material Handling Institute
8720 Red Oak Blvd. Suite 201
Charlotte, NC 28217

ANSI/MH 32.1-2018 Stairs, Ladders and Open-Edge Guards for Use with Material Handling Structures

Reason: The Material Handling Industry (MHI) has two product groups, Rack Manufacturer's Institute (RMI) and Storage Manufacturer's Association (SMA), that have compared and compiled OSHA and Building Code that apply to employee access ways serving various materials handling types of structures. The RMI and SMA have developed this compiled information into an ANSI consensus Standard ANSI/MH 32.1. This will give consistency and consistent interpretations between employee safety regulations promulgated by OSHA and the adopted IBC in local and state jurisdictions.

Cost Impact: The code change proposal will decrease the cost of construction
In a number of projects across the U.S. local jurisdictions have interpreted that Chapter 10 Means of Egress criteria applies to employee only access ways serving material handling structures. This will allow for less costly access devices to be used that are in compliance with OSHA regulations.

Staff Analysis: A review of the standard proposed for inclusion in the code, MHI ANSI/MH 32.1-2018 Stairs, Ladders and Open-Edge Guards for Use with Material Handling Structures, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S192-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

2212

STAIRS, LADDERS AND GUARDING FOR STEEL STORAGE RACKS AND INDUSTRIAL STEEL WORK PLATFORMS

~~**2209.4 Material handling stairs, ladders and guards.**~~ **2212.1 General.** The design and installation of stairs, ladders and guarding serving ~~material handling structures~~ steel storage racks and industrial steel work platforms shall be in accordance with ANSI/MH 32.1.

Committee Reason: Approved as modified as per the provided reason statement. The committee expressed concerns about the use of the new term 'guarding' in the new Sections 2212 and 2212.1. (Vote: 8-5)

S192-22

Individual Consideration Agenda

Public Comment 1:

IBC: 2212.1

Proponents: Gwenyth Searer, representing myself (gsearer@wje.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

2212.1 General. The design and installation of stairs, ladders and guarding serving steel storage racks and industrial steel work platforms <u>used in material handling structures</u> shall be in accordance with ANSI/MH 32.1.

Commenter's Reason: The original proposal (i.e., prior to the floor modification) covered stairs, ladders, and guards serving material handling structures. Since material handling structures are a specialized subset of elements in a building, this made sense. The floor modification, also proposed by the proponent, seemed innocuous at first blush; however, it has the potential to alter the governing requirements in an unanticipated way.
Consider a steel-framed platform that is used to service HVAC equipment in a building or a factory. Do the guards on that platform have to comply with IBC Section 1607.9, or do they have to comply with the MH 32.1 standard ("Stairs, Ladders, and Open-Edge Guards for Use with Material Handling Structures")? Do the stairs or ladder used to access the HVAC platform have to comply with the structural and architectural requirements in the IBC or do they have to only comply with the MH32,1 standard? If this proposal is adopted as modified by the committee. it is not clear.

In short, the floor modification appears to have inadvertently included all steel-framed platforms and work areas instead of limiting application of the MH 32.1 standard just to the very specialized subset of "industrial steel work platforms used in material handling structures", which is what the MH 32.1 standard covers. Extending the MH 32.1 to all "industrial steel work platforms" is simply not appropriate and makes it difficult to determine what provisions govern steel-framed floors or work areas in buildings and other structures that are not part of material handling structures.

This public comment corrects the as-modified proposal so that only those very specialized structures that MH 32.1 covers are governed by the MH 32-1 standard.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The intent of the public comment is to clarify that stairs, ladders, and guards that serve steel-framed work platforms are governed by the IBC unless they very specifically serve industrial steel work platforms used for material handling structures. This will not increase or decrease the cost of construction, but will simplify clarify which provisions apply where.

Public Comment# 3381

S201-22

IBC: 2303.2, 2303.2.1 (New), ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2021 International Building Code

Revise as follows:

2303.2 Fire-retardant-treated wood. *Fire-retardant-treated wood* is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a *listed flame spread index* of 25 or less. ~~Additionally, the~~ The ASTM E84 or UL 723 test shall be continued for ~~a~~ an additional 20-minute period and the flame front shall not progress more than $10^1/_2$ feet (3200 mm) beyond the centerline of the burners at any time during the test.

Add new text as follows:

2303.2.1 Alternate fire testing. A wood product impregnated with chemicals by a pressure process or other means during manufacture, which, when tested to ASTM E2768, has a listed flame spread index of 25 or less and where the flame front does not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test, shall also be considered fire-retardant-treated wood.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

E2768 -11(2018)	Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)

Reason: ASTM E2768 was developed specifically intended for code use. It is a standardized version of ASTM E84 with the extension from 10 minutes to 30 minutes (meaning an additional 20 minutes) and it measures exactly what the extended ASTM E84 does, namely flame spread index and flame front progression beyond the centerline of the burners. This standard is already included in the IWUIC and the language proposed is consistent with the IWUIC language.
The change to the existing section is for language consistency (the exact same language is being proposed in the IRC). It is best to state that the test is continued for "an additional" 20 minutes.

Note that this change adds a new section without deleting any existing section. Thus, sections 2303.2.1 through 2303.2.9 will have to be renumbered as 2303.2.2 through 2303.2.10.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is simple clarification/ ASTM E2768 is the same as the extended ASTM E84 test.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E2768 -11(2018) Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test), with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S201-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

2303.2.1 Alternate fire testing. ~~A~~ Fire-retardant-treated wood is also any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have ~~which~~, when tested in accordance with ~~to~~ ASTM E2768~~, has~~ a listed flame spread index of 25 or less and where the flame front does not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test~~, shall also be considered fire-retardant-treated wood~~.

Committee Reason: Approved as modified as the proposal appropriately adds a pointer to the ASTM E2768 as the alternate fire testing requirements. The modification provides the needed rewording to improve clarity of the intent. (Vote: 10-3)

S201-22

Individual Consideration Agenda

Public Comment 1:

Proponents: Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com); Mike Eckhoff, representing Hoover Treated Wood Products, Inc. (meckhoff@frtw.com) requests Disapprove

Commenter's Reason: We ask you overturn the committee decision. Multiple industry parties testified in the residential hearings and that committee agreed that the proper standard for Fire-Retardant-Treated Wood is already in use in the codes. By making this change, the structural committee has created a conflict within the code family as to the proper standard. Overturning the committee will eliminate any confusion for code officials, other authorities having jurisdiction, and the design community.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3321

Public Comment 2:

Proponents: Travis Hixon, representing Koppers Performance Chemicals (hixontd@koppers.com) requests Disapprove

Commenter's Reason: I recommend the committee overturn its decision to accept the changes to 2303.2.1 as modified. ASTM E84 (extended) is the correct test method for the evaluation of FRTW. Testing and evaluation of FRTW in accordance with ASTM E84 is available at every major test lab in the United States and is the method by which all major brands of FRTW are evaluated. Changing the testing requirement to ASTM 2768 will introduce unneeded confusion for users of the building code. The Fire Retardant Treated Wood industry is in consensus concerning this matter.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3476

Public Comment 3:

Proponents: Josh Roth, representing Arxada (joshua.roth@lonza.com) requests Disapprove

Commenter's Reason: As one of the manufactures of the chemicals for FRTW products, we do not support the decision to add ASTM E2768. Currently there are no issues with the existing language. The tests are very simalar but, ASTM E84 (extended) is and has been the correct test method for the evaluation of FRTW for many years. Testing and evaluation of FRTW, in accordance with ASTM E84, is available at every major test lab in the United States and is the method by which all major brands of FRTW are evaluated. Changing the testing requirement to ASTM 2768 will introduce unneeded confusion for users of the building code and an extra code section that serves no purpose. The Fire Retardant Treated Wood industry is in consensus concerning this matter.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3483

S202-22

IBC: 2303.2.5, 2303.2.5.1, 2303.2.5.2

Proposed Change as Submitted

Proponents: David Tyree, representing American Wood Council (dtyree@awc.org)

2021 International Building Code

Revise as follows:

2303.2.5 ~~Strength adjustments~~ Design values. Design values for ~~untreated lumber and *wood structural panels*,~~ *fire-retardant-treated wood*, including connection design values, shall be subject to all adjustments applicable to untreated wood as specified in this chapter and shall be further adjusted to account for the effects of the fire-retardant treatment. ~~Section 2303.1, shall be adjusted for *fire-retardant-treated wood*.~~ Adjustments to design values for the effects of the fire-retardant treatment shall be based on an *approved* method of investigation that takes into consideration ~~the effects of~~ the anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and the redrying procedures. Adjustments to flexural design values for fire-retardant-treated plywood shall be determined in accordance with Section 2303.2.5.1. Adjustments to flexural, tension, compression and shear design values for fire-retardant-treated lumber shall be determined in accordance with Section 2303.2.5.2.

2303.2.5.1 ~~Wood structural panels~~ Fire-retardant-treated plywood. The effect of treatment and ~~the method of~~ redrying after treatment, and any treatment-based effects due to exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed ~~by~~ in accordance with ASTM D5516 shall be used to develop treatment adjustment factors~~, maximum *loads* and spans, or both, for untreated plywood design values~~ in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum *loads* and spans for service as floor and roof sheathing for its treatment based on the adjusted design values and taking into account the climatological location.

2303.2.5.2 Fire-retardant-treated lumber. For each species of wood that is treated, the effect~~s~~ of ~~the~~ treatment~~, the method of~~ and redrying after treatment and any treatment-based effects due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed ~~by~~ in accordance with ASTM D5664 shall be used to develop ~~modification~~ treatment adjustment factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the ~~modification~~ treatment adjustment factors for service at maximum temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

Reason: Section 2303.2.5 is revised to clarify that design values for fire-retardant-treated wood products are subject to all of the adjustments for untreated wood products and also must be adjusted to account for the effect of the fire-retardant treatment. This clarification aligns with ASTM D5664/D6841 for lumber and ASTM D5516/D6305 for plywood. In both cases, the fire-retardant treatment adjustment factors isolate the additional effect of the fire-retardant treatment, but do not address how the constituent untreated wood materials themselves need to be adjusted for typical application conditions. For this reason, design values for fire-retardant-treated wood products must be adjusted by factors that are applicable to untreated wood as well as the treatment adjustment factors.
A new sentence is added at the end of 2303.2.5 to reference 2303.2.5.1 and 2303.2.5.2 as strictly pertaining to fire-retardant-treated plywood and fire-retardant-treated lumber, respectively. These subsequent sections have also been revised accordingly, to reflect the fact that the standards referenced therein are specific to fire-retardant-treated plywood and fire-retardant-treated lumber, respectively.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change provides clarification of the requirements consistent with the intent of existing code provisions and referenced standards.

S202-22

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approved as submitted as the proposal correctly clarifies the design values to align with ASTM D5664 and ASTM D5516. The committee expressed concerns with the deletion of the reference to 'wood structural panels' and with the addition of possibly unnecessary pointers. (Vote: 9-3)

S202-22

Individual Consideration Agenda

Public Comment 1:

Proponents: Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com); Mike Eckhoff, representing Hoover Treated Wood Products, Inc. (meckhoff@frtw.com) requests Disapprove

Commenter's Reason: We ask that membership overturn the committee. We disagree with the proponent's cost statement. It will increase the cost of construction if new testing is required. Additionally, the proponents are not clear as to the specific standards to which industry needs to test to become compliant. This same burden will also be placed upon the code officials, authorities having jurisdiction and design community as what to enforce or specify.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment request for disapproval would revert to the original code language; hence, no change.

Public Comment# 3322

S204-22

IBC: 2303.2.5, 2303.2.5.3 (New), ASTM Chapter 35 (New)

Proposed Change as Submitted

Proponents: Mike Eckhoff, representing Hoover Treated Wood Products, Inc. (meckhoff@frtw.com); James Gogolski, representing Hoover Treated Wood Products, Inc. (jgogolski@frtw.com)

2021 International Building Code

Revise as follows:

2303.2.5 ~~Strength~~ Design value adjustments. Design values for untreated lumber, ~~and~~ *wood structural panels*, and structural composite lumber, as specified in Section 2303.1, shall be adjusted for *fire-retardant-treated wood*. Adjustments to design values shall be based on an *approved* method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the *fire-retardant-treated wood* will be subjected, the type of treatment and redrying procedures.

Add new text as follows:

2303.2.5.3 Structural composite lumber. The effect of treatment and redrying after treatment and any treatment-based effects due to exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated laminated veneer lumber shall be determined in accordance with ASTM D8223. Each manufacturer shall publish reference design values and treatment-based design value adjustment factors in accordance with ASTM D8223.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

D8223-19	Practice for Evaluation of Fire-Retardant Treated Laminated Veneer Lumber

Reason: This change adds provisions for fire-retardant-treated laminated veneer lumber design values and adjustments for treatment effects to be developed in accordance with the new ASTM standard D8223.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Currently in the IBC, strength adjustments for fire-retardant-treated (FRT) wood structural panels and FRT lumber are contained in Sections 2303.2.5.1 and 2303.2.5.2, respectively. This proposal will add a third section for determining the strength adjustments for FRT structural composite lumber using the new standard ASTM D8223-19: Practice for Evaluation of Fire-Retardant Treated Laminated Veneer Lumber.

Any potential increase in the cost of construction will be due to the difference between the costs of the raw materials (e.g., untreated LVL vs. untreated dimensional lumber), **NOT** because of the added fire-retardant treatment as the process and thus, cost, for fire-retardant-treating structural composite lumber and untreated dimensional lumber is identical.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM D8223-19 Practice for Evaluation of Fire-Retardant Treated Laminated Veneer Lumber, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S204-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved consistent with the committee action on S203-22 and that the proposal may not cover all products available. (Vote: 13-0)

S204-22

Individual Consideration Agenda

Public Comment 1:

Proponents: Mike Eckhoff, representing Hoover Treated Wood Products, Inc. (meckhoff@frtw.com); James Gogolski, representing Hoover Treated Wood Products, Inc. (jgogolski@frtw.com) requests As Submitted

Commenter's Reason: This public comment addresses the committee's reason statement "that the proposal may not cover all products available." This public comment uses the more inclusive "structural composite lumber" rather than the limited "laminated veneer lumber." Laminated veneer lumber is a subset of "structural composite lumber" as shown in the definition below. Accepting this change will make this section consistent with the committee's action taken for S203.

As defined in the IBC, Section 202:

STRUCTURAL COMPOSITE LUMBER. Structural member manufactured using wood elements bonded together with exterior adhesives.

Examples of structural composite lumber in the IBC definition include:

1. Laminated strand lumber (LSL)
2. Laminated veneer lumber (LVL)
3. Oriented strand lumber (OSL)
4. Parallel strand lumber (PSL)

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Currently in the IBC, strength adjustments for fire-retardant-treated (FRT) wood structural panels and FRT lumber are contained in Sections 2303.2.5.1 and 2303.2.5.2, respectively. This proposal will add a third section for determining the strength adjustments for FRT structural composite lumber using the new standard ASTM D8223-19: Practice for Evaluation of Fire-Retardant Treated Laminated Veneer Lumber.

Any potential increase in the cost of construction will be due to the difference between the costs of the raw materials (e.g., untreated LVL vs. untreated dimensional lumber), NOT because of the added fire-retardant treatment as the process and thus, cost, for fire-retardant-treating structural composite lumber and untreated dimensional lumber is identical.

Public Comment# 3419

S205-22

IBC: 2303.3 (New)

Proposed Change as Submitted

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2021 International Building Code

Add new text as follows:

2303.3 Fire-retardant coated wood. The required flame spread index or smoke-developed index of an interior wood surface shall not be permitted to be achieved by the application on site of fire-retardant coatings, paints or solutions to surfaces. The application of factory-manufactured laminated products complying with Section 803.11 or the application of facings or veneers complying with Section 803.12 shall be acceptable methods of improving the flame spread index or smoke-developed index of such surfaces. Such factory-manufactured products shall not be considered fire-retardant-treated wood.

Reason: The IBC implicitly does not allow the use of fire retardant coatings added on site in new construction. The reason for that not being permitted is that it is not possible to properly control the adequate application of a surface treatment by a person working on site, which means that there is no assurance that the application will result in the surface being appropriately fire safe. Section 2303.2.2 explicitly prohibits the use of paints, coatings, stains or surface treatments as means to obtain fire retardant treated wood.

2303.2.2 Other means during manufacture. For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required in this section.

The language proposed mirrors exactly the language in Chapter 8 of the IBC, which distinguishes between laminated (or faced) products that are factory-produced and those that are applied on site. This also mirrors the requirements issued by ASTM when it developed practices ASTM E2404 and ASTM E2579. Sections 803.11 and 803.12 of the IBC explain how to assess the flame spread index and smoke developed index of wood substrates with added laminations, facings, or veneers, while making a clear distinction between those that are factory produced (803.11) and those that are applied on site (803.12). Neither section allows coatings to be used in new construction.

803.11 Laminated products factory produced with a wood substrate. Laminated products factory produced with a wood substrate shall comply with one of the following:

1. The laminated product shall meet the criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 using the product-mounting system, including adhesive, as described in Section 5.8 of NFPA 286.

2. The laminated product shall have a Class A, B, or C flame spread index and smoke-developed index, based on the requirements of Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.

803.12 Facings or wood veneers intended to be applied on site over a wood substrate. Facings or veneers intended to be applied on site over a wood substrate shall comply with one of the following:

1. The facing or veneer shall meet the criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, as described in Section 5.9 of NFPA 286.

2. The facing or veneer shall have a Class A, B or C flame spread index and smoke-developed index, based on the requirements of Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

The IFC does allow fire-retardant coatings to be used to bring the underlying surface up to code in section 803.4.

803.4 Fire-retardant coatings. The required flame spread or smoke-developed index of surfaces in existing buildings shall be allowed to be achieved by application of approved fire-retardant coatings, paints or solutions to surfaces having a flame spread index exceeding that allowed. Such applications shall comply with NFPA 703 and the required fire retardant properties shall be maintained or renewed in accordance with the manufacturer's instructions. The fire retardant paint, coating or solution shall have been assessed by testing over the same substrate to be used in the application.

What this proposal does is make it explicit what is now implicit, namely that coatings are not allowed to be used on-site to improve the flame spread index or smoke developed index of wood surfaces. However, it is permissible to ***bring to the site*** laminations, facings or veneers that have already been coated at a manufacturing facility.

(This proposal is intended to add a section and not to replace an existing section. Sections 2303.3 and subsequent ones would have to be renumbered.)

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

This is clarification of an implicit code requirement.

S205-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

2303.3 ~~Fire-retardant coated~~ Coated wood. The required flame spread index or smoke-developed index of an interior wood surface shall not be permitted to be achieved by the application on site of fire-retardant coatings, paints or solutions to surfaces. The application of factory-manufactured laminated products complying with Section 803.11 or the application of facings or veneers complying with Section 803.12 shall be acceptable methods of improving the flame spread index or smoke-developed index of such surfaces. Such factory-manufactured products shall not be considered fire-retardant-treated wood.

Committee Reason: Approved as modified as per the first paragraph of the provided reason statement. The committee did note that the new section might be a better fit in Chapter 8. The modification add consistency between the title and the provision in section 2303.3. (Vote: 8-5)

S205-22

Individual Consideration Agenda

Public Comment 1:

IBC: 2303.3

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

2303.3 Coated wood. ~~The required flame spread index or smoke-developed index of an interior wood surface shall not be permitted to be achieved by the application on site of fire-retardant coatings, paints or solutions to surfaces.~~ The application of factory-manufactured laminated products produced with a wood substrate,complying with Section 803.11, or the application of facings or veneers over a wood substrate , complying with Section 803.12, shall be acceptable methods of improving the flame spread index or smoke-developed index of such surfaces. Such factory-manufactured products shall not be considered fire-retardant-treated wood.

Commenter's Reason: Some of the testimony during the committee hearings related to whether the prohibition in the first sentence could be considered problematic. This public comment provides an option that still incorporates the critical information into the IBC without that sentence.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment does not change the crucial aspect of the proposal, which is a pointer to chapter 8 in the chapter on wood.

Public Comment# 3323

Public Comment 2:

IBC: 2303.3

Proponents: David Tyree, representing American Wood Council (dtyree@awc.org); Jason Smart, representing American Wood Council (jsmart@awc.org) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

2303.3 Coated wood. ~~The required flame spread index or smoke-developed index of an interior wood surface shall not be permitted to be achieved by the application on site of fire-retardant coatings, paints or solutions to surfaces.~~ The application of factory- coated~~manufacturedlaminated~~ wood products complying with Section 803.11 or the application of facings or veneers complying with Section 803.12 shall be acceptable methods of improving the flame spread index or smoke-developed index of such surfaces. ~~Such factory-manufactured products shall not be considered fire-retardant-treated wood.~~

Commenter's Reason: The first sentence of this proposed new section is omitted because it is not appropriate for the building code to prescriptively prohibit a whole class of products (in this case, field-applied coatings and paints). Acceptance or rejection of building products should be based on performance benchmarks, such as qualification standards developed through a consensus process. The last sentence is being omitted because the proposed new Section 2303.3 has nothing to do with FRTW. This proposed sentence conflates the flame spread index and smoke development index requirements for interior wood surfaces with the qualifications which are applicable to FRTW.
In the middle sentence, the term "factory-manufactured" is replaced with "factory-coated" and the term "laminated products" is replaced with "wood products" to more specifically describe the process and products addressed in this section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost impact statement for the originally proposed language of S205-22 incorrectly indicates that the proposal would not increase the cost of construction. In fact, the originally proposed language of S205-22 would prescriptively prohibit an entire class of building products, thereby increasing of the cost of construction by reducing the number of building product options. This public comment modifies proposed new section 2303.3 to remove the inappropriate prohibition. Thus, the net effect of this public comment and the code change proposal is cost-neutral.

Public Comment# 3260

Public Comment 3:

Proponents: David Anderson, representing Roseburg Forest Products requests Disapprove

Commenter's Reason: This public comment is urging disapproval of S205-22.
As a leading manufacturer of engineered wood and solid sawn wood products, the use of coatings applied in the field is common to comply with fire protection flame spread index and smoke developed index requirements. Code change proposal S205-22 is prohibiting the use of these field applied coatings over interior wood surfaces. Topical application of appropriate fire retardant products is acceptable and preferred over impregnated or pressure treatment as these methods may cause reductions in structural properties and impact dimensional stability of the wood.

Additionally, by prohibiting field applied coatings specifically over wood, but still allowing these coatings over spray polyurethane foam, steel, etc., this code change is inconsistent, unjustified, and unfavorable.

Through thorough examination of the product’s data, test reports, and quality control methods, product evaluation reports have been published by ICC-ES, IAPMO-UES and others to demonstrate and verify code compliance of various field applied fire protective coatings over wood.

This proposal limits potential options and is detrimental to wood product manufacturers, builders, and contractors in the field seeking fire protection methods.

Please disapprove this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3415

Public Comment 4:

Proponents: Gary Ehrlich, representing NAHB (gehrlich@nahb.org) requests Disapprove

Commenter's Reason: This public comment urges disapproval of S205. Contrary to the proponent’s reason statement and cost impact statement, this is not a clarification with no cost impact. In fact, the proposal will have a significant impact on the design of multifamily buildings and townhouses constructed under the IBC and significantly increase the cost of such projects.
There are several applications where use of fire retardant-coated products is preferred over FRTW or even necessary for certain structural products to be used. For example, it is common to use OSB treated with fire-retardant coating in lieu of needing to “swap in” 48” sections of FRTW plywood at townhouse separations. Alternatively, one can construct a row of townhouses with a consistent roof line using fire-retardant coated wood instead of needing to provide parapets between each unit. Finally, the use of intumescent coatings is necessary if using LVL’s, PSL’s or other engineered wood products that can’t be treated using a pressure process, especially if the architectural design calls for exposed members.

Incising lumber for pressure treatments results in a loss of structural capacity of 22-28%, thus requiring additional framing members at closer spacing, or deeper members to maintain the same spacing. Further, engineered wood products commonly used as rim or header members in exterior walls would need to be replaced with sawn lumber beams. Depending on the structural requirements, this can require a member that is wider than the wall and/or deeper than the floor system, necessitating a box-out that compromises the desire for straight wall and ceiling lines.

A blanket prohibition on the use of fire-retardant coatings even under an alternative means and methods process will have a significant cost impact on residential construction. Anecdotal reports from multifamily builders suggest having to use FRTW instead of approved fire-retardant coatings could increase the cost of a Type IIIA multifamily building by $150,000 to $180,000, which could translate to $1,000-$,2000 increase per dwelling unit.

The cost and availability of lumber, notably FRTW, have been significant issues for builders over the past few years. If the market hasn't improved by the time states begin to adopt the 2024 I-Codes, builders could be facing even higher project costs and longer delays than they already are experiencing with today's record-high lumber prices, with significant detrimental impacts on housing affordability.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment will result in no change from the 2021 IBC as it relates to fire-retardant coatings. The IBC will maintain the existing clarification in Section 2302.2.2 that fire-retardant coated wood is a separate product from fire-retardant treated wood, but the code will continue to allow fire retardant coatings to be used.

Public Comment# 3198

Public Comment 5:

Proponents: Ellen Henderson, representing DrJ Engineering requests Disapprove

Commenter's Reason: We are seeking disapproval of S205-22.
Approval of this language would eliminate an entire industry that has successfully provided fire protection services to the construction market for many years.

This proposal needs to be reviewed in the context of free trade requirements, where competition in a free market benefits American consumers through lower prices, better quality, and greater choice. The goal is to protect economic freedom and opportunity by promoting free and fair competition in the marketplace. Competition provides businesses the opportunity to compete on price and quality, in an open market and on a level playing field, unhampered by anticompetitive restraints. Competition also tests and hardens American companies at home, making them more likely to succeed abroad.[1]

The proponent's statement that the IBC implicitly prohibits the use of on-site applied fire retardant coatings is false. IBC Section 104.11 explicitly states, "The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code… An alternative material, design or method of construction shall be approved where the building official finds that the proposed alternative meets all of the following: 1) The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of this code, 2) The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following: 2.1. Quality.2.2. Strength. 2.3. Effectiveness. 2.4. Fire resistance.2.5. Durability. 2.6. Safety. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved."

There is a process in place through the use of approved agencies and approved sources that provide trade secret protection[2] and protect these trade secrets from access by competitors through public records regulations[3]. This process is called a "research report" and is defined in IBC Section 104.11 as, "Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources" (i.e. a professional engineer properly licensed and/or an ISO/IEC 17065 accredited agency).

The foregoing concepts are the means and methods of construction industry innovation.

The mechanisms for approval confidence include but are not limited to: testing by an ISO/IEC 17025 agency, third party inspection by a ISO/IEC 17020 agency, product code compliance evaluation by an ISO/IEC 17065 agency, accepted engineering practice by an approved source, registered design professional review, and/or a company's product performance liability. If this is not the case, a free market cannot exist because the building code or the enforcement of the building code gets to pick winners and losers.[4]

The proponent states; "The reason for that [coatings added on-site] not being permitted is that it is not possible to properly control the adequate application of a surface treatment by a person working on site, which means that there is no assurance that the application will result in the surface is implying that on-site application." Is the building code intended to prescribe a step-by-step prescriptive guide to installing every product used in the construction environment? If this is the case, a good place to start would be to add a code requirement for installing nails in OSB with a 3/8" minimum edge distance per AWC's Special Design Provisions Wind and Seismic. This edge distance is shown to be critical to performance, but has never been a code requirement.

The method of installation cannot be a critical code compliance question, given this is a key component of the manufacturer's installation instructions, their product performance liability, a means and methods of construction issue, and an IBC Section 110 issue.

The proponent quotes IBC Section 2303.2.2 as justification for prohibiting paints, stains and coatings. This is also a misrepresentation of the code. This section specifically addresses products that treat materials as a part of the manufacturing process. It is not relevant to field applied products.

Furthermore, during the development of this language in prior code cycles, the language was modified from, "The use of paints, coating, stains or other surface treatments is not an approved method of protection" to "The use of paints, coating, stains or other surface treatments is not an approved method of protection **as required in this section.**" The addition of the "as required by this section" language was to clearly express that this section is dealing with fire retardants that are integral to the manufacturing process and not with other types of fire retardant applications. Testimony provided by the proponents of this change confirm that products approved through the free market provisions of the code, as advocated by 104.11, are essential to innovation.

The proponent's reference to the IFC Section 803.4 supports that the code already explicitly allows the use of fire retardant coatings, paints, or solutions to be applied to achieve the required performance.

Finally, the code already explicitly permits the use of fire retardant coatings for the purpose of fire resistance. Sprayed Fire Resistant Materials (SFRM) are used throughout the code in many applications and are installed on-site. This sets a key precedent.

The effect, if not the intent, is to eliminate fire retardant coated wood competition. Please disapprove this proposal.

[1]

https://www.justice.gov/atr/mission

[2] https://www.americanbar.org/groups/business_law/publications/blt/2016/09/03_cohen/

[3] https://www.muckrock.com/news/archives/2019/mar/08/sw-state-guide/

[4] https://www.justice.gov/atr/mission

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3281

Public Comment 6:

Proponents: Jeff Hire, representing Installed Building Products requests Disapprove

Commenter's Reason: Negative Cost impact and elimination of multiple construction options.
Installed Building Products is a publicly traded company on the NYSE and one of the largest insulation installers in the residential and commercial new construction markets in the U.S. with more than 185 locations, and a leading installer of complimentary products, such as No-Burn intumescent field-applied coatings.

Eliminating materials that have been used successfully and approved in the marketplace for decades is inappropriate and damaging to the industry. Eliminating options is never good. Other codes allow for field applied fire-retardant coatings, paints or solutions to surfaces, and there is and has been no call for the elimination of field-applied fire protection coatings, in general or specific to any substrates.

Our position is that it is 100% detrimental to eliminate the option of field-applied fire-retardant coatings, paints or solutions. For many commonly used wooden materials, there would be no solution without a field-applied coating. If there is a mistake made in the field, the wood or other substrate needing fire protection would have to be removed and construction would have to wait for the new material, causing further delays and additional costs. This type of proposal clearly is designed to eliminate competition and is not real world based.

We highly urge for disapproval of S205-22.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

As disapproval will revert to original code language; therefore, no cost impact.

Public Comment# 3278

Public Comment 7:

Proponents: James Lynch, representing Self (jlynch@firesolutionsgroup.com) requests Disapprove

Commenter's Reason: To whom it may concern:
This public comment urges disapproval of S205 and is written to document a rebuttal to the statement that it is “not possible to properly control the adequate application of surface treatment by a person working on site, which means that there is no assurance that the application will result in the surface be appropriately fire safe.” This statement was made in support of text to establish a new IBC section 2303.3 that would not permit the application of on site fire-retardant coatings, paints or solutions to surfaces to meet required flame spread index or smoke-developed index requirements of an interior wood surface.

The above statement is not only false but also not justification for eliminating the use of flame retardant coatings. Chapter 17 of the IBC itself contains sections on the testing of sprayed fire-resistant materials, mastic and intermesent fire resistant coatings. Specifically, sections 1705.14 provides physical and visual tests including;

1) Condition of substrate

2) Thickness of application

3) Density in pounds per cubic ft (kg/m3)

4) Bond strength adhesion / cohesion)

5) Condition of finished application.

Furthermore, section 1705.15 entitled *Mastic and Intermesent Fire Resistant Coatings* provides special inspection and testing based on “approved construction documents” and the Association of Wall and Ceiling Industry (AWCI) Technical Manual 12-B, entitled *Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials.*

Included with this letter is an example field report (er-305.pdf) of the inspection and testing results of a coating that the purposed new IBC section and text would eliminate. It is clear that inspection and testing is regularly done to control the adequate application of surface treatment by a person working on site. There is clearly a means to assure that the application will result in the surface being appropriately fire safe.

https://www.cdpaccess.com/public-comment/3247/27274/files/download/3600/ER-305.pdf

In addition, even if this testing could not occur, it would not be justification for the elimination of the application of fire-resistant coatings in the field. There are many fire protection devices, equipment, building and construction assemblies that are not installed as tested to a standard. As many are aware standards are not meant to replicate real world conditions rather create a benchmark for performance. In addition to installing fire protection outside the conditions they were tested many fire protection features are not tested in the field to determine the functionality due to the hazard of in filed fire testing or the destructive nature of in situ testing.

The proposed change would have a significant impact on construction cost, another reason for the disapproval of S205.

Sincerely,

James A Lynch

CEO

The Fire Solutions Group LLC

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York, PA 17401

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Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3247

Public Comment 8:

Proponents: Jon Traw, representing Traw Associates Consulting requests Disapprove

Commenter's Reason: S205-22 should be disapproved. The reasons given by the proponent are in some cases either not factual or based on personal opinions of the application of code provisions. The proponent first states that the code implicitly eliminates coatings, paints and solutions from being accepted for the purpose of treating wood substrates to achieve flame spread and smoke development requirements. It is doubtful that building and fire officials would agree with this opinion since they have approved the use of coatings, paints and solutions for decades using product evaluation reports.
A quick review of ICC ES product evaluation reports and listings shows that there at least seven (7) reports or listings for coatings, paints and solutions used to treat substates including dimensional lumber, plywood, OSB and wood siding. Apparently, the ICC ES does not concur with the proponents opinion that the code implicitly eliminates coatings, paints and solutions use to treat wood substrates.

The proponent further states "… it is not possible to properly control the adequate application of a surface treatment by a person on-site. No data validating this claim was submitted or presented at the hearing. In fact, there are numerous examples of cases where on-site application of surface treatments have been widely accepted by authorities having jurisdiction. Examples include spray applied coatings to provide fire resistance protection for steel, application of coatings to wood based substrates to achieve flame spread and smoke development limitations of the code, application of spray applied coatings for protection of foam plastic and application of coatings, paints and solutions to decorative materials to achieve compliance with referenced fire test standards and code requirements. In general, the acceptance of on-site applications are based on product evaluation reports that directly address how to properly control the application of the coating, paint or solutions.

The proponent further attempts to use the language of the last sentence of Section 2303.2.2 as a basis for the totally eliminating the use of coatings, paints or solutions to meet flame spread and smoke limitations of Chapter 8. This sentence concerns restrictions for classification as fire retardant treated wood. The proposal goes well beyond the applicability of this restriction.

The proponent also suggests that the provisions of Section 803.11 and 803.12 provide a basis for the proposed change. These sections deal with laminate products and facings or wood veneers and in not way constitute a rationale for the global elimination of coatings, paints or solutions as currently acceptable methods of obtaining the required flame spread and smoke development limitations of the code.

The proponent references Section 803.4 of the IFC and implies that the wording of the provisions only refers to existing buildings and thus infers that coatings, paints or solutions would not be allowed for new buildings. The wording of the IFC purposely refers to existing buildings because the code itself in many cases is oriented to deal with the maintenance of existing buildings since new construction would be regulated by the IBC. If coatings, paints or solutions are allowed for use in existing buildings under the IFC then it would be reasonable to conclude that the same apply to new buildings if tested in accordance with required fire test standards. Again, there are numerous product evaluation reports covering the use of coatings, paints and solutions to meet the flame spread and smoke development restrictions of the code.

In conclusion, no evidence of product failures was submitted justifying the proposed total elimination of currently accepted products or the use of existing ICC ES evaluation reports or listings.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 3279

Public Comment 9:

Proponents: Philip Trzcinski, representing No-Burn Inc (phil@noburn.com) requests Disapprove

Commenter's Reason: The proposal is directed at only a specific aspect of fire retardant coatings – field applied to wood. It is not against factory applied coatings and it makes no mention of the use of field applied coatings over other substrates, such as foam plastics or structural steel, to achieve code compliance. The reasoning given is that there are no quality controls for a coating applied on site to wood. In fact, the same controls to achieve up to 3 hour fire ratings over steel and 15 minute thermal barrier requirements for foam plastics are in use for wood substrates as well – certified installers, third party inspection of the installation to verify required mil thickness, etc. It would be understandable if the proposal was aimed at all fire retardant coatings, but it is not. Field applied coatings have been used successfully in thousands of projects annually, whether they be structural steel fire ratings, thermal / ignition barrier for foam plastics, structural wood applications, corrosion protection, roof coatings, water barriers, air barriers, coatings over piping and other metal coatings for buildings and tunnels.
The purpose of code development is to identify a problem and correct it in the name of building safety; not to eliminate competition or to limit the products available to meet the spirit and intent of the code. That is exactly what this proposal does. It attempts to limit coatings or paints for fire protection, but even goes a step farther in attempting to eliminate an installation method that has proven success. Eliminating the use of field applied coatings would only allow for a limited number of manufacturers to provide products and again, the purpose of code development is not to eliminate competition.

By no longer allowing the use of field applied coatings over wood, this new Section 2303.3 negatively impacts many industry stakeholders, such as but not limited to, National Association of Home Builders (NAHB), American Wood Council (AWC), The Engineered Wood Association (APA), American Coatings Association (ACA), and The American Institute of Architects (AIA).

I strongly recommend disapproval.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The public comment will not increase or decrease the cost of construction as methods and materials already in use will continue to be utilized to meet current code. However, the original proposal would increase the cost of construction by limiting the available products to meet code, thereby increasing demand on other products and driving up prices. The proposal also limits new and innovative products from being considered that may be more cost effective options to meet current codes.

Public Comment# 3253

Public Comment 10:

Proponents: Larry Wainright, representing DrJ Engineering (lwainright@drjengineering.org) requests Disapprove

Commenter's Reason: We are seeking disapproval of S205-22. Approval of this language would eliminate an entire industry that has successfully provided protection services to the construction market for many years.
The proponent's statement that the IBC implicitly prohibits the use of on-site applied fire retardant coatings is false. The IBC explicitly states that, "The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved." (IBC section 104.11) The code has well established that what is not prohibited in the code, is permitted within the context of alternate materials or methods of construction. The method of installation is not the critical question. Rather, what is the performance of the installed product?

The proponent quotes section 2303.2.2 as justification for prohibiting paints, stains and coatings. This is also a misrepresentation of the code. This section is specifically addressing products that treat materials as a part of the manufacturing process. It is not relevant to field applied products. Further, during the development of this language in prior code cycles, the language was modified from, "The use of paints, coating, stains or other surface treatments is not an approved method of protection" to "The use of paints, coating, stains or other surface treatments is not an approved method of protection **as required in this section."** The addition of the "as required by this section" language was to clearly express that this section is dealing with fire retardants that are integral to the manufacturing process and not with other types of fire retardant applications. Testimony provided by the proponents of this change testified that products approved through the alternate means would still be allowed, but are now trying to eliminate this competition.

The proponent's reference to the IFC, section 803.4 supports that the code already explicitly allows the use of fire retardant coatings, paints or solutions to be applied to achieve the required performance.

Finally, the code already explicitly permits the use of fire retardant coatings for the purpose of fire resistance. Sprayed Fire Resistant Materials (SFRM) are used throughout the code in many applications and are installed on-site. If they can be used successfully for fire resistance, can they not also be used to control flame spread?

Please disapprove this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No change to code.

Public Comment# 3232

S212-22

IBC: 2304.10.1, AWC Chapter 35 (New)

Proposed Change as Submitted

Proponents: Jason Smart, representing American Wood Council (jsmart@awc.org); David Tyree, representing American Wood Council (dtyree@awc.org)

2021 International Building Code

Revise as follows:

2304.10.1 Connection fire-resistance rating. *Fire-resistance* ratings for connections in Type IV-A, IV-B or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the *fire-resistance* test.
2. Engineering analysis <u>in accordance with the AWC FDS or other approved method</u> that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required *fire-resistance* rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners and portions of wood members included in the structural design of the connection.

Add new standard(s) as follows:

AWC

American Wood Council
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

<u>AWC FDS-2022</u> <u>Fire Design Specification (FDS) for Wood Construction</u>

Reason: A reference is added in 2304.10.1(2) to the American Wood Council Fire Design Specification (FDS), which includes provisions for the design of fire protection for wood connections. The Fire Design Specification is available on AWC's website (<u>https://awc.org/codes-standards/publications/fds-2021</u>) and is being developed as an AWC standards in accordance with AWC's consensus standards development process. Completion is anticipated to occur prior to the Public Comment Hearing.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal provides a reference to the AWC FDS, which contains provisions that provide an acceptable means by which the analysis in 2303.10.1(2) may be performed; however, it does not necessarily preclude the use of other analysis methods.

Staff Analysis: A review of the standard proposed for inclusion in the code, AWC FDS-2022 Fire Design Specification (FDS) for Wood Construction, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 16, 2022.

S212-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved per the proponent's request and that the referenced standard is not complete. (Vote: 13-0)

S212-22

Individual Consideration Agenda

Public Comment 1:

Proponents: David Tyree, representing American Wood Council (dtyree@awc.org); Jason Smart, representing American Wood Council (jsmart@awc.org) requests As Submitted

Commenter's Reason: At the request of the proponent (AWC), S212-22 was disapproved at the Committee Action Hearings because the Fire Design Specification for Wood Construction (FDS) was still going through the consensus development process at the time. This action was consistent with the action taken on other proposals to introduce references to new standards still under consensus development. Completion of this consensus development process is anticipated to occur for the FDS prior to the Public Comment Hearing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Reference to the new Fire Design Specification in 2304.10.1 would provide the designer with necessary information and procedures for designing protection of wood connections which could reduce costs; however, it doesn't preclude the use of other analysis methods.

Staff Analysis: In accordance with Section 3.6.3.1.1 of ICC Council Policy 28, the new referenced standard AWC FDS-2022, must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

Public Comment# 3082

S224-22

IBC: SECTION 2308.3 (New), 2308.3.1 (New), 2308.3.2 (New), 2308.3.2.1 (New), 2308.3.3 (New), 2308.3.4 (New), 2308.3.5 (New), 2308.4.2.4, 2308.5.9, 2308.5.10, 2308.7.4; IPC: 307.2, 307.3 (New), [BS] C101.1, [BS] C101.2, [BS] C101.3; IMC: [BS] 302.3, [BS] 302.3.1, [BS] 302.3.2, [BS] 302.3.3; IFGC: [BS] 302.3, [BS] 302.3.2, [BS] 302.3.3, [BS] 302.3.4

Proposed Change as Submitted

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org)

2021 International Building Code

Add new text as follows:

SECTION 2308.3
CUTTING, NOTCHING AND BORING

2308.3.1 Scope. The provisions of Section 2308.3 shall only apply to dimensional wood framing and shall not include engineered wood products, heavy timber, or pre-fabricated/manufactured wood assemblies.

2308.3.2 Floor joists, roof rafters, and ceiling joists. Notches on framing ends shall not exceed one-fourth the member depth. Notches in the top or bottom of the member shall not exceed one-sixth the depth and shall not be located in the middle third of the span. A notch not more than one-third of the depth is permitted in the top of a rafter or ceiling joist not further from the face of the support than the depth of the member. Holes bored in members shall not be within 2 inches (51 mm) of the top or bottom of the member and the diameter of any such hole shall not exceed one-third the depth of the member. Where the member is notched, the hole shall not be closer than 2 inches (51 mm) to the notch.

2308.3.2.1 Ceiling joists. Where ceiling joists also serve as floor joists, they shall be considered floor joists within this section.

2308.3.3 Wall studs. In *exterior walls* and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support *loads* other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.

2308.3.4 Bored holes. The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall not be closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

2308.3.5 Limitations. In designated lateral-force resisting system assemblies designed in accordance with this code and greater than three-stories in height or in Seismic Design Categories C, D, E, and F, the cutting, notching and boring of wall studs shall be as prescribed by the registered design professional.
In structures designed in accordance with the International Residential Code, modification of wall studs shall comply with the International Residential Code.

Delete without substitution:

~~**2308.4.2.4 Notches and holes.** Notches on the ends of joists shall not exceed one-fourth the joist depth. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist.~~

~~**2308.5.9 Cutting and notching.** In *exterior walls* and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support *loads* other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.~~

~~**2308.5.10 Bored holes.** The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall not be closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.~~

~~**2308.7.4 Notches and holes.** Notching at the ends of rafters or ceiling joists shall not exceed one-fourth the depth. Notches in the top or bottom of the rafter or ceiling joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span, except that a notch not more than one-third of the depth is permitted in the top of the rafter or ceiling joist not further from the face of the support than the depth of the member. Holes bored in rafters or ceiling joists shall not be within 2 inches (51 mm) of the top and bottom and their diameter shall not exceed one-third the depth of the member.~~

2021 International Plumbing Code

Revise as follows:

307.2 Cutting, notching <u>and boring of cold-formed steel framing.</u> ~~or bored holes~~. A <u>cold-formed</u> framing member shall not be cut, notched or bored in excess of limitations specified in the *International Building Code*.

Add new text as follows:

<u>**307.3 Cutting, notching and boring of wood framing.** The cutting, notching and boring of structural wood framing members shall comply with Section 2308.3 of the *International Building Code.*</u>

Delete without substitution:

~~**[BS] C101.1 Joist notching.** Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.~~

~~**[BS] C101.2 Stud cutting and notching.** In exterior walls and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support loads other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.~~

~~**[BS] C101.3 Bored holes.** The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall be notcloser than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.~~

2021 International Mechanical Code

Revise as follows:

[BS] 302.3 Cutting, notching and boring in wood framing. The cutting, notching and boring of wood framing members shall comply with Section~~s~~ <u>2308.3 of the *International Building Code.*</u> ~~302.3.1 through 302.3.4.~~

Delete without substitution:

~~**[BS] 302.3.1 Joist notching.** Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.~~

~~**[BS] 302.3.2 Stud cutting and notching.** In exterior walls and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support loads other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.~~

~~**[BS] 302.3.3 Bored holes.** The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall be not closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall be not located at the same section of stud as a cut or notch.~~

2021 International Fuel Gas Code

Revise as follows:

[BS] 302.3 Cutting, notching and boring in wood members. The cutting, notching and boring of wood <u>framing</u> members shall comply with Section~~s~~ <u>2308.3 of the *International Building Code.*</u> ~~302.3.1 through 302.3.4.~~

Delete without substitution:

~~**[BS] 302.3.2 Joist notching and boring.** Notching at the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top and bottom of the joist and their diameters shall not exceed one-third the depth of the member. Notches in the top or bottom of the joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span.~~

~~**[BS] 302.3.3 Stud cutting and notching.** In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched to a depth not exceeding 25 percent of its width. Cutting or notching of studs to a depth not greater than 40 percent of the width of the stud is permitted in nonload-bearing partitions supporting no loads other than the weight of the partition.~~

~~**[BS] 302.3.4 Bored holes.** The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in~~

~~wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall be not closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.~~

Reason: This proposal consolidates similar wood cutting, notching and boring criteria from the IFGC, IMC, IPC, and IBC into a single location in the IBC, and does not impose new requirements or restrict any practices currently allowed within the I-Codes. The proposed language draws from current language in the IPC, IMC, and IFGC and IBC provisions in the conventional light-framed section. The existing language was used to the greatest extent possible and relocated to minimize technical changes.
Within the IBC, existing wood framing notching, cutting and boring provisions have been relocated into a single new Section 2308.3. This reorganization into one location makes the IBC provisions easy to find and will provide clear and consistent criteria across all trades on how to field modify framing members and when modification of such members requires input from a design professional.

Structural framing members are frequently modified in the field by non-structural trades, to facilitate the installation of mechanical, electrical, plumbing, and other utilities. Especially in conventional light-framed wood construction, such modifications are rarely overseen by a design professional with knowledge of critical framing elements that should remain unmodified and the role they play within the structure.

It is unrealistic to expect field personnel to continually seek the guidance of a design professional for every framing member requiring modification. However, modifications of critical framing members have the potential to negatively impact the integrity of the structure and the utility systems that rely on that structure for support. The resulting structural deficiencies caused by field modifications to framing members may only be realized during significant high-wind, seismic, impact, or other loading events that, while within the normal structure design criteria, are outside every day operating conditions. At best, such deficiencies may be realized by local deformation of finish materials and at worst, by partial or full collapse of a structure.

Currently, the IFGC, IMC, IPC, and IBC all provide guidance on modification of structural framing elements within the path of utilities. Although the guidance provided by each code is similar, they are not identical in wording or scope and are handled differently within each document.

Differences include but are not limited to:

- IFGC, IMC: The cutting and notching criteria is within the main body of the code.
- IFGC, IMC: Includes direction for wood, steel, cold-formed steel, and non-structural cold-formed steel materials.
- IPC: Points to the IBC for cutting and notching criteria but provides Appendix C as an alternate. · IPC Appendix C
  - Includes some, but not all, cutting and notching criteria and limitations found within the IFGC and IMC.
  - Does not address steel and cold-formed materials.

This proposal is submitted by the ICC Building Code Action Committee (BCAC).

BCAC was established by the ICC Board of Directors in July 2011 to pursue opportunities to improve and enhance assigned International Codes or portions thereof. In 2020 and 2021 the BCAC has held several virtual meetings open to any interested party. In addition, there were numerous virtual Working Group meetings for the current code development cycle, which included members of the committee as well as interested parties. Related documents and reports are posted on the BCAC website at https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/building-code-action-committee-bcac/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal consolidates existing and slightly varied provisions from multiple locations into one location within the wood chapter of the International Building Code.

Staff Analysis: CC# S196-22 and CC# S224-22 addresses requirements in a different or contradicting manner. The committee is urged to make their intentions clear with their actions on these proposals.

S224-22

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Disapproved as the proposal needs additional work as it affects multiple codes which address different multiple trades and it is appropriate to leave the requirements in each code as is currently done. (Vote: 11-3)

Staff Analysis: CC# S196-22 and CC# S224-22 addresses requirements in a different or contradicting manner. The committee is urged to make their intentions clear with their actions on these proposals.

Individual Consideration Agenda

Public Comment 1:

IBC: SECTION 2308.3, 2308.3.1, 2308.3.2, 2308.3.2.1, 2308.3.3, 2308.3.4, 2308.3.5; IPC: 307.3; IMC: [BS] 302.3; IFGC: [BS] 302.3

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org) requests As Modified by Public Comment

Modify as follows:

2021 International Building Code

~~SECTION 2308.3~~
~~CUTTING, NOTCHING AND BORING~~

2304.14 **~~2308.3.1~~** **Cutting, Notching, and Boring of Sawn Lumber** **~~Scope~~.** The provisions of Section 2304.14 ~~2308.3~~ shall only apply to dimensional wood framing and shall not include engineered wood products, heavy timber, or pre-fabricated/manufactured wood assemblies.

2304.14.1 **~~2308.3.2~~** **Floor joists, roof rafters, and ceiling joists.** Notches on framing ends shall not exceed one-fourth the member depth. Notches in the top or bottom of the member shall not exceed one-sixth the depth and shall not be located in the middle third of the span. A notch not more than one-third of the depth is permitted in the top of a rafter or ceiling joist not further from the face of the support than the depth of the member. Holes bored in members shall not be within 2 inches (51 mm) of the top or bottom of the member and the diameter of any such hole shall not exceed one-third the depth of the member. Where the member is notched or bored, the notch or hole shall not be closer than 2 inches (51 mm) to ~~the~~ another notch or bore.

2304.14.1.2 **~~2308.3.2.1~~** **Ceiling joists.** Where ceiling joists also serve as floor joists, they shall be considered floor joists within this section.

2304.14.2 **~~2308.3.3~~** **Wall studs.** In *exterior walls* and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support *loads* other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.

2304.14.3 **~~2308.3.4~~** **Bored holes.** The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall not be closer than $^5/_8$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located ~~at~~ within two inches of the same section of stud as a cut or notch.

2304.14.4 **~~2308.3.5~~** **Limitations.** In designated lateral-force resisting system assemblies designed in accordance with this code and greater than three-stories in height or in Seismic Design Categories C, D, E, and F, the cutting, notching and boring of wall studs shall be as prescribed by the registered design professional.
~~In structures designed in accordance with the International Residential Code, modification of wall studs shall comply with the International Residential Code.~~

2021 International Plumbing Code

307.3 Cutting, notching and boring of wood framing. The cutting, notching and boring of structural wood framing members shall comply with Section 2304.14 ~~2308.3~~ of the *International Building Code.*

2021 International Mechanical Code

[BS] 302.3 Cutting, notching and boring in wood framing. The cutting, notching and boring of wood framing members shall comply with Section 2304.14 ~~2308.3~~ of the *International Building Code*.

2021 International Fuel Gas Code

[BS] 302.3 Cutting, notching and boring in wood members. The cutting, notching and boring of wood framing members shall comply with Section 2304.14 ~~2308.3~~ of the *International Building Code*.

Commenter's Reason: This public comment relocates the wood frame notching and cutting provisions from the proposed Section 2308.3 into a

new Section 2304.14. This relocation addresses the Committee concerns that Section 2308.3 was limited in scope only to conventional light frame construction and could not be used in other wood frame applications.
The Committee indicated the notching and cutting provisions for wood framing should remain in each of the utility codes and the language correlated to match. However the Committee approved S196-22, the companion proposal for cold-formed steel framing that took the same approach by pointing the utility codes to AISI S240 and AISI S220 documents for notching and cutting provisions.

It is inconsistent to point outside of the utility codes for cold-formed steel framing, yet require wood framing to remain within each utility code. Cutting and notching of wood framing is a structural consideration that should remain within Chapter 23 of the IBC in a single section that does not require the language to be correlated across multiple codes and disciplines.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal consolidates existing and slightly varied provisions from multiple locations into one location within the wood chapter of the International Building Code.

Public Comment# 3016

S227-22

IBC: 2308.7.5, TABLE 2308.7.5

Proposed Change as Submitted

Proponents: Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

2021 International Building Code

Revise as follows:

2308.7.5 Wind uplift. The roof construction shall have rafter and truss ties to the wall below. Resultant uplift *loads* shall be transferred to the foundation using a continuous *load* path. The rafter or truss to wall connection shall comply with Tables 2304.10.2 and 2308.7.5.

> **Exception:** The truss to wall connection shall be permitted to be determined from the uplift forces as specified on the truss design drawings or as shown on the *construction documents*.

TABLE 2308.7.5 REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)[a, b, c, e, f, g, h]

~~NOMINAL~~ BASIC DESIGN WIND SPEED, V~~asd~~[i]	ROOF SPAN (feet)							~~OVERHANGS (pounds/feet)[d]~~
	12	20	24	28	32	36	40	
EXPOSURE B								
~~85~~ 90	~~-72~~ 64	~~-120~~ 85	~~-145~~ 96	~~-169~~ 107	~~-193~~ 117	~~-217~~ 128	~~-241~~ 139	~~-38.55~~
~~90~~ 100	~~-91~~ 102	~~-151~~ 139	~~-181~~ 158	~~-212~~ 177	~~-242~~ 195	~~-272~~ 214	~~-302~~ 233	~~-43.22~~
~~100~~ 110	~~-131~~ 144	~~-281~~ 199	~~-262~~ 226	~~-305~~ 254	~~-349~~ 282	~~-393~~ 310	~~-436~~ 338	~~-53.36~~
~~110~~ 120	~~-175~~ 190	~~-292~~ 265	~~-351~~ 302	~~-409~~ 339	~~-467~~ 377	~~-526~~ 414	~~-584~~ 452	~~-64.56~~
130	-240	-335	-382	-431	-479	-528	-576	
140	-294	-411	-470	-530	-590	-650	-710	
EXPOSURE C								
90	-126	-175	-199	-223	-247	-272	-296	
100	-179	-250	-285	-320	-356	-391	-426	
110	-238	-332	-380	-428	-476	-525	-573	
120	-302	-424	-485	-547	-608	-669	-731	
130	-371	-521	-597	-674	-751	-828	-904	
140	-446	-628	-719	-812	-904	-997	-1090	
EXPOSURE D								
90	-166	-232	-265	-298	-311	-364	-396	
100	-229	-321	-367	-413	-459	-505	-551	
110	-298	-418	-478	-539	-601	-662	-723	
120	-373	-526	-603	-679	-756	-833	-910	
130	-455	-641	-734	-829	-924	-1020	-1114	
140	-544	-767	-878	-992	-1106	-1220	-1333	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 33 ~~30~~ foot mean roof height~~located in Exposure B. For Exposure C or D and for other mean roof heights, multiply the loads by the following adjustment coefficients:~~ .

	~~Mean Roof Height (feet)~~									
~~EXPOSURE~~	~~15~~	~~20~~	~~25~~	~~30~~	~~35~~	~~40~~	~~45~~	~~50~~	~~55~~	~~60~~
~~B~~	~~1.001.001.001.001.051.091.121.161.19~~									~~1.22~~
~~C~~	~~1.211.291.351.401.451.491.531.561.59~~									~~1.62~~
~~D~~	~~1.471.551.611.661.701.741.781.811.84~~									~~1.87~~

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements ~~do not account for~~ include the effects of 24" overhangs. ~~The magnitude of the loads shall be increased by adding the overhang loads found in the table. The overhang loads are based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.~~

e. The uplift connection requirements are based on wind loading on end zones as defined in Figure 28.3-1 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.75 ~~and multiplying the overhang load by 0.8~~.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of $V_{\cancel{asd}}$ and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications.

i. $V_{\cancel{asd}}$ shall be determined in accordance with Section 1609.3~~.1~~.

Reason: The reason for this code change is to update the roof to wall connection loads to comply with the IBC referenced wind design standard, ASCE 7-16. The current loads are based on a very old version of ASCE 7. That can be seen by the use of the term V-asd. ASD wind loads have not been used since ASCE 7-10. The wind uplift loads need to be updated to the Ultimate Wind Speeds (now just called Basic Design Wind Speeds) used in ASCE 7-16 (and ASCE 7-22). That way the windspeeds will match the required Basic Design Windspeeds of Figures 1609.3(1) through 1609.3(12).
By adding a Basic Wind Speed down to 90 mph, there will be entries for the new lower Basic Wind Speed maps. Without these entries, users in those areas would have to use the entry for 85 mph V-asd, which converts to nearly 110 mph, meaning they would be overdesigning.

The new exception is added to allow the truss to wall connection to be designed using either the loads on the truss design drawings or the construction documents. That language is meant to be similar to Section R802.11.1, Truss uplift resistance, in the IRC.

This code change will not be affected if ASCE 7-22 is adopted as a referenced standard in the 2024 IBC.

Bibliography: American Wood Council
ANSI/AWC WFCM—2018: Wood Frame Construction Manual for One- and Two-Family Dwellings

ASCE/SEI American Society of Civil Engineers

ASCE 7—16 with Supplement 1: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Cost Impact: The code change proposal will increase the cost of construction
Depending on the Basic Wind Speed, this code change can either increase or decrease the cost of construction.

In areas with higher Basic Wind Speed, there may be an increase in costs, as the listed wind loads were previously incorrect.

Comparing 110 mph Basic Windspeed to 90 mph ASD, the uplift loads are around 15% greater for common roof spans. That small of a difference frequently will not make a difference in the choice of connector for roof to wall connection.

However, for lower Basic Wind Speed areas, there will be a cost savings. The new table has the benefit of being able to use this table for lower windspeeds as shown in the new Basic Wind Speed Maps, which would not have been possible without these changes. Using the lowest listed V-asd, 85 mph, and then converting to Basic Wind Speeds using Section 1609.3.1, only Basic windspeeds above 110 could be used, because when converted that results in 85 mph V-asd. With the new tables Basic Wind Speeds between less than 110 down to 90 mph will have table entries, so they will have lower costs.

S227-22

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

TABLE 2308.7.5 REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)[a, b, c, e, f, g, h]

BASIC ~~DESIGN~~ WIND SPEED, *V* [i]	ROOF SPAN (feet)						
	12	20	24	28	32	36	40
EXPOSURE B							
90	-64	-85	-96	-107	-117	-128	-139
100	-102	-139	-158	-177	-195	-214	-233
110	-144	-199	-226	-254	-282	-310	-338
120	-190	-265	-302	-339	-377	-414	-452
130	-240	-335	-382	-431	-479	-528	-576
140	-294	-411	-470	-530	-590	-650	-710
EXPOSURE C							
90	-126	-175	-199	-223	-247	-272	-296
100	-179	-250	-285	-320	-356	-391	-426
110	-238	-332	-380	-428	-476	-525	-573
120	-302	-424	-485	-547	-608	-669	-731
130	-371	-521	-597	-674	-751	-828	-904
140	-446	-628	-719	-812	-904	-997	-1090
EXPOSURE D							
90	-166	-232	-265	-298	-311	-364	-396
100	-229	-321	-367	-413	-459	-505	-551
110	-298	-418	-478	-539	-601	-662	-723
120	-373	-526	-603	-679	-756	-833	-910
130	-455	-641	-734	-829	-924	-1020	-1114
140	-544	-767	-878	-992	-1106	-1220	-1333

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 33 -foot mean roof height.

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements include the effects of 24" overhangs.

e. The uplift connection requirements are based on wind loading on end zones as defined in Figure 28.3-1 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.75 .

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of *V* and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications. <u>The required rating of approved uplift connectors is based on Allowable Stress Design loads.</u>

i. *V* shall be determined in accordance with Section 1609.3.

Committee Reason: Approved as modified to coordinate the roof uplift with ASCE 7. The modification clarifies the requirements for Allowable Stress Design and updates the terminology to ASCE 7. (Vote: 14-0)

S227-22

Individual Consideration Agenda

Public Comment 1:

IBC: TABLE 2308.7.5

Proponents: Jeffrey Munsterteiger, representing National Association of Home Builders (jmunsterteiger@nahb.org) requests As Modified by Public Comment

Further modify as follows:

2021 International Building Code

TABLE 2308.7.5 REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)[a, b, c, e, f, g, h]

BASIC WIND SPEED, *V*[i]	ROOF SPAN (feet)						
	12	20	24	28	32	36	40
EXPOSURE B							
90	~~-64~~ -16	~~-85~~ -13	~~-96~~ -12	~~-107~~ -11	~~-117~~ -9	~~-128~~ -8	~~-139~~ -7
100	~~-102~~ -54	~~-139~~ -67	~~-158~~ -74	~~-177~~ -81	~~-195~~ -87	~~-214~~ -94	~~-233~~ -101
110	~~-144~~ -96	~~-199~~ -127	~~-226~~ -142	~~-254~~ -158	~~-282~~ -174	~~-310~~ -190	~~-338~~ -206
120	~~-190~~ -142	~~-265~~ -193	~~-302~~ -218	~~-339~~ -243	~~-377~~ -269	~~-414~~ - 294	~~-452~~ -320
130	~~-240~~ -192	~~-335~~ -263	~~-382~~ -298	~~-431~~ -335	~~-479~~ -371	~~-528~~ -408	~~-576~~ -444
140	~~-294~~ -246	~~-411~~ - 339	~~-470~~ -386	~~-530~~ -434	~~-590~~ -482	~~-650~~ - 530	~~-710~~ -578
EXPOSURE C							
90	~~-126~~ -78	~~-175~~ -103	~~-199~~ -115	~~-223~~ - 127	~~-247~~ -139	~~-272~~ -152	~~-296~~ -164
100	~~-179~~ 131	~~-250~~ -178	~~-285~~ -201	~~-320~~ -224	~~-356~~ -248	~~-391~~ -271	~~-426~~ -294
110	~~-238~~ -190	~~-332~~ -260	~~-380~~ -296	~~-428~~ -332	~~-476~~ -368	~~-525~~ -405	~~-573~~ -441
120	~~-302~~ -254	~~-424~~ - 352	~~-485~~ -401	~~-547~~ -451	~~-608~~ -500	~~-669~~ -549	~~-731~~ -599
130	~~-371~~ -323	~~-521~~ -449	~~-597~~ -513	~~-674~~ -578	~~-751~~ - 643	~~-828~~ -708	~~-904~~ -772
140	~~-446~~ -398	~~-628~~ -556	~~-719~~ -635	~~-812~~ - 716	~~-904~~ - 796	~~-997~~ -877	~~-1090~~ -958
EXPOSURE D							
90	~~-166~~ -118	~~-232~~ -160	~~-265~~ -181	~~-298~~ - 202	~~-311~~ -223	~~-364~~ -244	~~-396~~ -264
100	~~-229~~ -181	~~-321~~ -249	~~-367~~ -283	~~-413~~ -317	~~-459~~ -351	~~-505~~ -385	~~-551~~ -419
110	~~-298~~ -250	~~-418~~ -346	~~-478~~ -394	~~-539~~ - 443	~~-601~~ -493	~~-662~~ -542	~~-723~~ -591
120	~~-373~~ -325	~~-526~~ -454	~~-603~~ -519	~~-679~~ -583	~~-756~~ -648	~~-833~~ -713	~~-910~~ -778
130	~~-455~~ -407	~~-641~~ -569	~~-734~~ -650	~~-829~~ -733	~~-924~~ -816	~~-1020~~ -900	~~-1114~~ -982
140	~~-544~~ -496	~~-767~~ -695	~~-878~~ -794	~~-992~~ - 896	~~-1106~~ -998	~~-1220~~ -1100	~~-1333~~ -1201

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 33 -foot mean roof height.

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for ~~10~~ 15 pounds of dead load.

d. The uplift connection requirements include the effects of 24" overhangs.

e. The uplift connection requirements are based on wind loading on end zones as defined in Figure 28.3-1 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.75 .

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of *V* and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications. The required rating of approved uplift connectors is based on Allowable Stress Design loads.

i. *V* shall be determined in accordance with Section 1609.3.

Commenter's Reason: The stated purpose of the International Building Code is to establish minimum requirements to provide a reasonable level of safety through structural strength, among other objectives. This proposal as modified by this public comment provides a reasonable level of safety by providing an effective minimum requirement. The proposal approved as modified by the committee assumed an overly conservative roof/ceiling dead load of 10 pounds-per-square-foot (psf) as described in submittal footnote c, whereas this public comment is based on a more realistic assumed roof/ceiling dead load of 15 psf. This public comment modifies the uplift connection loads to reflect this more realistic roof/ceiling dead load of 15 psf and table footnote c accordingly to reflect the new load.The 2001 report *Structural Design Loads for One- and Two-Family Dwellings* provides a table of typical dead loads for common residential conditions that specifies a dead load for roof/ceiling construction, comprised of light wood or steel framing (trusses), sheathing & gypsum board ceiling, with asphalt shingles, metal roofing, or wood shakes or shingles of 15 psf. The use of typical dead loads in this proposal is important as the weight of the structure offsets the uplift effects of wind and minimizes prevents hold-down connection requirements. Further, per the allowable stress load combinations in ASCE 7, only 60% of the dead load is considered as offsetting the wind uplift loads. If the assumed dead load is too conservative, the resulting load used in the calculations may be less than the actual materials present. The use of a 15 psf dead load would also be consistent with the assumed roof/ceiling load used in other prescriptive design requirements applicable to light frame construction such as *Minimum Width and Thickness for Concrete Footings For Light-Frame Construction* table R403.1(1) and the Rafter Or Truss Uplift Connection Forces From Wind Table R802.11. With the increases in attic insulation required by energy codes the actual weight of materials has increased.

Bibliography: https://www.huduser.gov/portal/publications/destech/strdesign.html

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment lowers the cost of construction by reducing the likelihood of over building.

Public Comment# 3096
