IRC - Building

2019 GROUP B PUBLIC COMMENT AGENDA

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ICC
INTERNATIONAL
CODE COUNCIL®

2019 Public Comment Agenda

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RB1-19

IRC®: R104.11, R104.11.1 (New), R104.11.1.1 (New), R104.11.2, R106.3.1.1 (New), 202 (New)

Proposed Change as Submitted

Proponents: Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

2018 International Residential Code

R104.11 Alternative materials, design and methods of construction and equipment. 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. The *building official* shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The *building official* shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with the specific performance-based provisions of the International Codes shall be an alternative to the specific requirements of this code. 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*.

Add new text as follows:

R104.11.1 Research reports. 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.

R104.11.1.1 Approved sources. Agencies conducting product certification or product evaluation shall be accredited by an accreditation body. The scope of accreditation shall include the acceptance criteria referenced in the research report, for the research report to be accepted for product approval.

Revise as follows:

~~**R104.11.1**~~ **R104.11.2 Tests.** Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *building official* shall have the authority to require tests as evidence of compliance to be made at no expense to the *jurisdiction*. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *building official* shall approve the testing procedures. Tests shall be performed by an *approved* agency. Reports of such tests shall be retained by the *building official* for the period required for retention of public records.

Add new text as follows:

R106.3.1.1 Third-party certification. Products and materials required by the code to be in compliance with a referenced standard shall be *certified* by a *third-party certification agency* as complying with the referenced standards. Products and materials shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

Add new definition as follows:

ACCREDITATION BODY. An approved, third-party organization that is independent of the grading, product certification and inspection agencies that initially accredit and subsequently monitors agencies conducting building product certification or evaluation schemes on a continuing basis, including the competency and performance of a grading or inspection agency related to carrying out specific tasks.

Reason: The standard practice in building products conformity assessment involves accreditation of the agencies by an accreditation body such as ISO. Third party testing, manufacturing inspections and product certification or product evaluation provide a higher level of quality assurance on these activities for the building official. Approved sources that issue research reports must be accredited to the specific acceptance criteria referenced in the research report. This ensures that the approved sources have the requisite technical expertise and experience to conduct such activities on behalf of the building official. Harmonized language is proposed for inclusion a new Section R106.3.1.1 regarding third-party certification, and in Chapter 2 with a definition for accreditation body. A definition for Third-Party Certification Agency already exists in the IRC and remains unchanged. The language in the new Section R106.3.1.1 is identical to language in the International Plumbing Code Section 303.4. The added definition is the same as that proposed for inclusion in the International Building Code. These additions will improve the consistency and intent of the I-codes.

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

RB1-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This would require every product to have a listing with a large cost impact. Some standards do not require testing. Every engineer and agency would require certification. This would limit innovation. This hamstrings the ability of code officials to approve alternatives. The code official already has the right to choose what credentials are required in Section R104.9 so this proposal is unnecessary. (Vote: 11-0)

Assembly Action: **None**

RB1-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R104.11.1.1 (New), R106.3.1.1 (New)

Proponents:
Michael Savage, representing Compliance Code Action Committee (CCAC) (ccac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R104.11.1.1 Approved sources <u>for product certification or product evaluation</u>. ~~Agencies conducting product certification or product evaluation shall be accredited by an accreditation body. The scope of accreditation shall include the acceptance criteria referenced in the research report, for the research report to be accepted for product approval.~~ <u>Product certification and product evaluations shall be performed by agencies that are accredited by an accreditation body or shall be performed by registered design professionals. The scope of accreditation shall include the standard or acceptance criteria referenced in the research report, for the research report to be accepted for product approval.</u>

~~**R106.3.1.1 Third-party certification.** Products and materials required by the code to be in compliance with a referenced standard shall be *certified* by a *third-party certification agency* as complying with the referenced standards. Products and materials shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.~~

Commenter's Reason: Comments were received that the section "Approved Sources" conflicts with the definition of "Approved Source" elsewhere in the code. The section title was revised and clarified to pertain specifically to agencies conducting product certification and product evaluation.
Comments were received that in some cases, registered design professionals may already do product certification or product evaluation for certain types of building products. The text was revised to include registered design professionals.

Comments were received that the term "acceptance criteria" was limiting. This is not the case, as the term "acceptance criteria" already appears many times throughout the code, and the meaning is well understood. "Standards" were added alongside "acceptance criteria", as research reports may be based on standards or acceptance criteria.

Comments were received that requiring third-party certification by third-party certification agencies would create an undue burden and was not necessary for all building products in the code. The third- party certification requirement is consequently deleted. The definition for third-party certification agency is currently in the code and shall remain.

The new definition for "Accreditation Body" is consistent with the revised definition in ADM23-19 Part II.

For the reasons above, we strongly encourage overturning the committee and approving the code change as modified by this public comment.

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 removes the requirement for third party certification.

Public Comment# 1469

RB2-19

IRC®: R105.2

Proposed Change as Submitted

Proponents: Lee Schwartz, representing Self (lee@hbaofmichigan.com)

2018 International Residential Code

Revise as follows:

R105.2 Work exempt from permit. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:

Building:

1. One-*story* detached *accessory structures,* provided that the floor area does not exceed 200 square feet (18.58 m^2).
2. Fences ~~not over 7 feet (2134 mm) high.~~
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.
4. Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. Sidewalks and driveways.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
8. Swings and other playground equipment.
9. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
10. Decks not exceeding 200 square feet (18.58 m^2) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. *Listed* cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, *appliances,* apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical *equipment* to *approved* permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying *appliances*.
2. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
3. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating *appliances*.
2. Portable ventilation *appliances*.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.

5. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

Reason: The International Residential Code contains no definition of “fence”, no listing of “fence” in the index and no sections or subsections specifically governing the material, design or method of construction for a fence. In short there are <u>no</u> specific code requirements for fences found in the International Residential Code. This leaves permit applicants to searching in vain thorough the entire IRC to find requirements for the construction of a fence when none exist. It also places inspectors in the unenivable position of having to inspect fences for which a permit was pulled without any criteria for approving the fence construction. How can a building official write a violation notice when there are no pertinent requirements to base the notice on?

While the IRC does contain an exemption for fences not over 7 feet high. This is an arbitrary number chosen for convenience and without without any data to back it up. Is a fence that is 7 feet two inches inherently more dangerous to the publis health, safety and general welfare than a fence that is 6 feet 11 1/2 inches?

The purpose of the code is to establish minimum <u>requirements</u> to safeguard the public safety, health and general welfare. Mandating the issuance of a construction permit for fences when <u>no</u> minimum requirements are specifically present in the code book does not safeguard the public safety, health and general welfare.

Requiring a permit for a fence, even with the under seven feet exeption, simply because the code states you must have a permit aqnd without any standards is exactly the type of overeach which leads to people not pulling permits on other, more critical, construction.

In most jurisdictions, requirements for fences have been treated as a zoning issue with zoning ordinances controlling the size, type, materials and manner of construction for a fence. The requirment for a fence permit should be totally removed from the IRC and left to local zoning.

Cost Impact: The code change proposal will decrease the cost of construction
by eliminating an unnecessary permit and the fee for that permit.

RB2-19

<u>Public Hearing Results</u>

Committee Action: **As Submitted**

Committee Reason: There are no prescriptive requirements in the IRC for fences. This exempts requirements for permits. It does not exempt code requirements. If something needs to be regulated by the code, the code official still has the authority. It just exempts inspections. Many jurisdictions regulate fences over a certain height and that is a local issue.
In opposition: In some jurisdictions, fences are usually built of masonry and are very heavy and present structural concerns. This could allow tall fences without permits. Fences in general would be more appropriately addressed by zoning or municipal engineering requirements and the IRC is not the place to address them.

(Vote: 6-4)

Assembly Action: **None**

RB2-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R105.2, 202 (New)

Proponents:
J Daniel Dolan, representing Federal Emergency Management Agency/ Applied Technology Council Seismic Codes Support Committee (jddolan@wsu.edu); Kelly Cobeen, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R105.2 Work exempt from permit. Exemption from *permit* requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this *jurisdiction*. *Permits* shall not be required for the following:

Building:

1. One-*story* detached *accessory structures,* provided that the floor area does not exceed 200 square feet (18.58 m^2).
2. Fences not more than 8 feet (2400 mm) in height and weighing not more than 5 psf.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.

4. Free standing walls, not supporting a surcharge, that are 4 ft (1220 mm) or less in height as measured from the top of the wall to the lowest adjacent grade.

~~4.~~ 5. Water tanks supported directly upon *grade* if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.

~~5.~~ 6. Sidewalks and driveways.

~~6.~~ 7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.

~~7.~~ 8. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.

~~8.~~ 9. Swings and other playground equipment.

~~9.~~ 10. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.

~~10.~~ 11. Decks not exceeding 200 square feet (18.58 m^2) in area, that are not more than 30 inches (762 mm) above *grade* at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. *Listed* cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, *appliances,* apparatus or *equipment* operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical *equipment* to *approved* permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying *appliances*.
2. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.

3. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating *appliances*.
2. Portable ventilation *appliances*.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling *equipment* regulated by this code.
5. Replacement of any minor part that does not alter approval of *equipment* or make such *equipment* unsafe.
6. Portable evaporative coolers.
7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell *appliances* that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a *permit* shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

[RB] FREESTANDING WALL. A man-made structure built of rock, block, timber, concrete or similar material that does not directly support retained material or serve as a facing of a cut slope. This definition does not include standard wooden privacy fences as used in residential applications.

Commenter's Reason: This public comment adds a new definition to differentiate free standing walls from fences. By doing this, the fences that were the concern of the original proponent will not require a permit until they exceed eight feet, thereby allowing most common residential fences. The free standing walls that present a higher earthquake hazard will require permits when over four feet and constructed of heavier materials. This will help to protect the safety of the dwelling occupants and pedestrians. In most moderate to major earthquakes extensive damage to, and collapse of, free standing walls is observed. The photos below are of partially collapsed six foot high walls in the recent Searles Valley (Ridgecrest) Earthquake. This is an example of a common residential free standing wall that could cause harm.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This change will probably increase the cost of construction for heavy walls, but the increase in design and inspection will also improve the safety and durability of the walls.

Public Comment# 1464

RB5-19

IRC®: 202 (New)

Proposed Change as Submitted

Proponents: Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

2018 International Residential Code

Add new definition as follows:

BUILDING DESIGNER. The owner of the building or the person that contracts with the owner for the design of the building structural system or who is responsible for the preparation of the construction documents. Where required by the statutes of the jurisdiction in which the project is to be constructed, the building designer shall be a registered design professional.

Reason: The title "building designer" is currently used twice within the IRC, in Section R502.11.4 and Section R802.10.1. In each of the two sections, "building designer" refers to a person who is qualified and responsible for designing the size, connections, and anchorage of the permanent continuous lateral bracing. Therefore, a definition of the title providing the qualifications of the individual is necessary.
Furthermore, nearly every State allows for individuals other than "registered design professionals" to prepare construction drawings for those buildings covered under the scope of the IRC. Therefore, it is essential to the correct interpretation of the code that the title "building designer" is clarified by definition to avoid potential confusion and misinterpretation of the actual qualifications and prerequisites required of those individuals given the responsibility to design one- and two-family dwellings and townhouses.

Standard ANSI/TPI 1 includes a definition of "building designer" and this proposal largely mirrors the ANSI/TPI 1 definition with a small deviation to remain consistent with verbiage in Section R106.1.

Standard ANSI/TPI 1 is a nationally developed consensus standard referenced by the IRC. Therefore, it makes logical sense to include the currently accepted definition of "building designer" for clarity, for consistency, and to avoid referencing two separate documents for the same information.

References:

"ANSI/TPI 1, 2.2 Definitions:

Building Designer: *The owner of the building or the Person that contracts with the Owner for the design of the Building Structural System and/or who is responsible for the preparation of the Construction Documents. When mandated by the Legal Requirements, the Building Designer shall be a Registered Design Professional."*

"Section R106.1 Submittal Documents

...The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed..."

"R502.11.4 Truss design drawings.

*11. Maximum axial compression forces in the truss members to enable the **building designer** to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or on supplemental documents."*

"R802.10.1 Truss design drawings.

*11. Maximum axial compression forces in the truss members to enable the **building designer** to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents."*

Bibliography: ANSI/TPI 1 - 2014, August 27, 2014, Truss Plate Institute, Alexandria, VA

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not change the current practice of building design, or who is qualified to perform the task.

RB5-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The second sentence is unnecessary. This definition is already covered in the definition of registered design professional. This would create potential conflicts with the IRC and state laws. This is confusing and needs work. (Vote: 9-2)

Assembly Action: **None**

RB5-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 202 (New)

Proponents:
Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

BUILDING DESIGNER. The ~~owner of the building or the~~ person ~~that contracts with the owner~~ responsible for the design of the building's structural system or ~~who is responsible~~ for the preparation of the construction documents. ~~Where required by the statutes of the jurisdiction in which the project is to be constructed, the building designer shall be a registered design professional.~~

Commenter's Reason: This proposal has been reworded in an effort to address the following concerns expressed by the committee upon disapproval.

- The second sentence is unnecessary.
- This is confusing and needs work.

However, I strongly disagree with the committee's position that, "This definition is already covered in the definition of a *registered design professional."* On the contrary, **this definition focuses on the function of an individual** rather than referencing only statutory requirements, which is what the definition of a *registered design professional* does.

Moreover, although both titles are used within the IRC, a *registered design professional* may be a *building designer,* but a building designer **may not have to be** a *registered design professional.* This is a distinct difference and this proposal is intended to make it clear that when the title *building designer* is used, the latter scenario may typically be the case.

I also disagree with the committee's statement, "This would create potential conflicts with the IRC and state laws." This is an example of the confusion, or bias, within the industry that this proposal seeks to clarify. Nearly every state statute allows for **persons other than** *registered design professionals* to design single-family dwellings, townhouses covered by the IRC are also included in the majority of states. Section 106.1 of the IRC recognizes this.

The American Insitute of Building Design encourages the approval of this submittal as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
There is no cost impact, the intent of the proposal is to provide clarification, only.

Public Comment# 1803

RB7-19

IRC®: [RB] 202

Proposed Change as Submitted

Proponents: Lucas Pump, representing Self (l.pump@cedar-rapids.org)

2018 International Residential Code

Revise as follows:

[RB] CRAWL SPACE. An unfinished underfloor space that is not a basement.

Reason: The current definition for "crawl space" is too broad. According the current definition, I could walk into the main level of a 2-story house, and stand in the living room, and I could call that area a "crawl space". I would be under the floor of the second floor, and not in a basement, but I believe that we could all agree that this 1st floor is not a "crawl space". So, adding this additional language helps define the space better.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is just clarification of the definition, and should not have a cost impact.

RB7-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee is unsure what the term "unfinished" means. The proposal is not consistent with the intent indicated in the proponent's reason statement. (Vote: 11-0)

Assembly Action: **None**

RB7-19

Individual Consideration Agenda

Public Comment 1:

IRC®: [RB]

Proponents:
Lucas Pump, representing Self (l.pump@cedar-rapids.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] CRAWL SPACE. An ~~unfinished~~ underfloor space that is not a basement and is not habitable space.

Commenter's Reason: After listening to the reason from the Committee Action Hearings, I believe that this change to "is not habitable space" is better than "unfinished". The primary reason was that the committee didn't like "unfinished" because to was not well defined. But, I think "not habitable space" would put the area into a category of a normally unoccupied and/or uninhabitable space which is currently well defined.
As stated previously, the current definition for "crawl space" is too broad. According the current definition, I could walk into the main level of a 2-story house, and stand in the living room, and I could call that area a "crawl space". I would be under the floor of the second floor, and not in a basement, but I believe that we could all agree that this 1st floor is not a "crawl space". So, adding this additional language helps define the space better.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is just clarification of the definition which is currently very vague, and should not have a cost impact.

RB10-19

IRC®: [RB] 202

Proposed Change as Submitted

Proponents: Thomas Meyers, representing Self (codeconsultant@gmail.com)

2018 International Residential Code

Revise as follows:

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. ~~To an imaginary line between two buildings on the *lot*.~~

The distance shall be measured at a right angle from the face of the wall.

Reason: The definition for fire separation distance is identical to that in the IBC. Unlike the IBC, the IRC does not have a requirement to use an "imaginary line" for fire separation distance assessment. It's retention in the definition creates confusion and should therefore be eliminated.

Cost Impact: The code change proposal will decrease the cost of construction
Elimination of unnecessary and confusing language may result in cost reductions where the imaginary line was erroneously applied.

RB10-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are many cases where we basically eliminate fire separation distance requirements for dwelling units, accessory buildings, etc. But we do get multiple IRC buildings and sometimes IBC mixed uses on the same lot and without the concepts of fire separation distance and "imaginary line" the code does not work. No workable alternative has been provided. The original language provides a level of safety for multiple buildings on the same lot. (Vote: 11-0)

Assembly Action: **None**

RB10-19

Individual Consideration Agenda

Public Comment 1:

IRC®: [RB] 202, R302.1, R302.1.1 (New)

Proponents:
David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.

3. To an imaginary line between two buildings on the *lot*.

The distance shall be measured at a right angle from the face of the wall.

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings* and accessory buildings shall comply with Table R302.1(1); or *dwellings* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

R302.1.1 Buildings on the same lot. For the purposes of determining *fire separation distance* and the requirements of Section R302.1, buildings on the same *lot* shall have an imaginary line established between them. Imaginary lines shall extend to a *lot line* or to another imaginary line.

Where a new building is to be erected on the same *lot* as an existing building, the location of the imaginary line with relation to the existing building shall be such that the existing building meets requirements of Section R302.1.

Commenter's Reason: The discussion during the committee action hearings was that there is a need to to keep the imaginary line concept in the definition of fire separation distance. Imaginary lines are necessary to establish exterior wall requirements between buildings on a lot such as two (or more) dwellings or two (or more) buildings containing townhouse units. Because of this, the original proposal to delete the imaginary line concept was appropriately disapproved by the committee. However, the hearing discussion made it apparent that there is a need to add requirements in the body of the code for establishing imaginary lines. This public comment maintains the imaginary line concept in the definition of fire separation distance and provides a new sub-section in the code to dictate where and how to establish imaginary lines. Also, this public comment addresses the condition where a new building is added to an existing lot - this is needed so a new building doesn't cause an existing building to become non-compliant with regard to fire-resistant exterior wall requirements.

It should be noted that Exception 2 to Section R302.1 (which is included in this public comment for reference only) exempts walls between dwelling units and their accessory structures from fire-resistant exterior wall requirements and this public comment does not change this. Even though an imaginary line is established between these buildings, Exception 2 still applies and the imaginary lines are not used.

I urge your support of this public comment that brings clarity to the code by adding requirements for establishing imaginary lines between buildings on the same lot. This is an improvement that will bring consistent interpretation and enforcement of fire-resistant exterior wall requirements for buildings on the same lot.

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 simply clarifies current code requirements, so there should be no change in the cost of construction.

Public Comment# 1359

RB11-19

IRC®: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

[RB] Flashing. A non-corrosive, water-resistant material, installed to resist water entry, and direct water away from or out of the building assembly.

Reason: There is a need to prevent water from seeping in and causing damage to the home's walls, ceilings and other assemblies. This water is causing structural damage to the home, or creating moisture and mold problems throughout the home. This form of protection is a necessary construction practice, and it's widely applied to commercial, residential and industrial structures within the industry. Therefore, there is a need to define flashing

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no Cost Impact with this Change

RB11-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is no qualification for water resistance. This proposal conflicts with Section R507.2.4, which requires "metal." The committee encourages the proponent to work on the application of other materials. (Vote: 11-0)

Assembly Action: **None**

RB11-19

Individual Consideration Agenda

Public Comment 1:

IRC®: (New)

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

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] Flashing. A ~~non-corrosive~~ corrosion-resistant, water-resistant material or system, installed to resist water entry, and direct water away from or out of the building assembly.

Commenter's Reason: The term “flashing” appears over in 50 sections of the IRC. As described in these sections of the code, flashing is required to prevent water from entering the interior of a building at roof/wall penetrations, the perimeter of windows and doors, etc. Traditionally, flashing is thought of as metal. However, innovation has brought to the market non-metal flashings such as butyl and acrylic tapes and liquid-applied products that meet the criteria for preventing water penetration. The use of a combination of materials has resulted in flashing systems, in which the individual components are tested along with the entire system and found to meet the applicable performance criteria.

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 adding a definition where none existed before, without creating any new technical requirements at all.

Public Comment# 1809

RB14-19

IRC®: [RB] 202 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

[RB] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. ~~A window or other~~ An emergency and escape and rescue opening located such that the ~~sill~~ height of the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also "Emergency escape and rescue opening.")

Reason: This definition is used only in Section IRC R310.2.1. The change to the definition is so is matches how it will be used in the technical criteria. What is a 'sill' is not clear – the modification is for consistency with technical criteria. It is important to indicate that this is to the bottom of the opening (otherwise a below grade window could be very deep). See also revisions to IRC R310.2.1. There was a similar proposal approved for Group A for IBC - G4-18(AS).
This is one of a series of proposal to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a coordination item for requirements for EEROs already permitted between the codes.

RB14-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The language change in the definition needs to be changed in the body of the code as well in each instance it occurs. This is a good concept that could be addressed in the public comment period. (Vote: 11-0)

Assembly Action: **None**

RB14-19

Individual Consideration Agenda

Public Comment 1:

IRC®: [RB], [RB] 202 (New), R310.2, R310.2.1

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency. (See also "Grade floor emergency escape and rescue opening.")

[RB] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An emergency escape and rescue opening located such that the height of the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also "Emergency escape and rescue opening.")

R310.2 Emergency escape and rescue openings. Emergency escape and rescue openings shall have minimum dimensions as specified in this section.

R310.2.1 Minimum opening area. Emergency and escape rescue openings shall have a net clear opening of not less than 5.7 square feet (0.530 m^2). The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. The net clear height of the opening shall be not less than 24 inches (610 mm) and the net clear width shall be not less than 20 inches (508 mm).

> **Exception:** *Grade floor emergency escape and rescue openings* or *below-grade openings* shall have a net clear opening area of not less than 5 square feet (0.465 m^2).

Commenter's Reason: This public comment addresses the concern the code committee had at the Committee Action Hearings held in Albuquerque NM by revising the defined term in the other two locations of the IRC where the term exists.
This public comment 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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a coordination item for requirements for EEROs already permitted between the codes.

Public Comment# 1246

RB20-19

IRC®: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

PORCH. An open, screened, or glazed, one story portion of a building that is separated by a thermal envelope, and has a space conditioning system exceeding 3.4 Btus or 1 watt of energy use at peak operation, or that is capable of being shut off without shutting off the space conditioning system to other areas of the building.

Reason: *There is no industry standard language as to what a porch is defined as. Many times a deck becomes a porch and then actually becomes conditioned space. The code does define decks and conditioned spaces but not a porch. Therefor there is a need for a definition of what a porch actually is. This language is very similar to the same language used to define a sunroom, in the code with some modifications*

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase the cost of construction and may actually decrease the costs because it creates a consistent definition of what a porch is, no longer do the code official and builder need to guess how it is going to be permitted, defined and built or what are the code requirements that need to be met.

RB20-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The changes in this proposal are not necessary. Definitions should not contain requirements. All porches are not conditioned. (Vote: 11-0)

Assembly Action: **None**

RB20-19

Individual Consideration Agenda

Public Comment 1:

IRC®: (New)

Proponents:
Ann Houske Jacklitch, representing AMBO IRC Code Committee (ajacklitch@maplegrovemn.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

PORCH. An open, screened, or glazed, ~~one story~~ unconditioned portion of a building. ~~that is separated by a thermal envelope. , and has a space conditioning system exceeding 3.4 Btus or 1 watt of energy use at peak operation, or that is capable of being shut off without shutting off the space conditioning system to other areas of the building.~~

Commenter's Reason: We have removed the references to conditioned spaces and number of stories. Conditioned spaces are regulated as additions or sunrooms, rather than as porches, and porches can be multi-story.

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 will not increase the cost of construction and may actually decrease the cost because it creates a consistent definition of what a porch is.

Public Comment# 1523

RB22-19

IRC®: [RB] 202

Proposed Change as Submitted

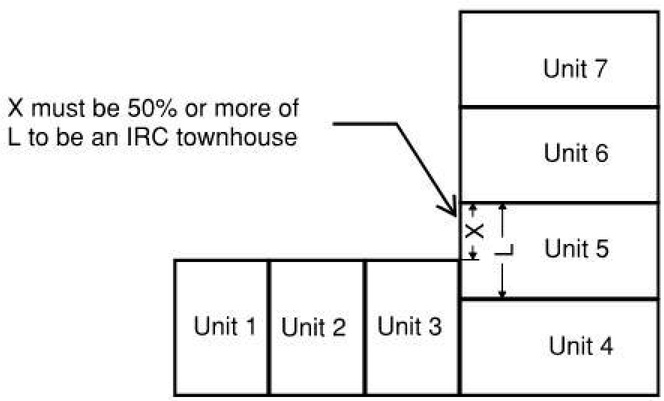
Proponents: David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

2018 International Residential Code

Revise as follows:

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and ~~with~~ has a yard or public way on not less than two sides that extends at least 50 percent of the length of each of these two sides.

Reason: The definition of "townhouse" requires a yard or public way on not less than two sides, which is intended to provide some degree of independence from the other townhouse units in a building; however, the definition does not dictate the length required for the yard or public way. This proposal requires a minimum of 50% of the length of a side to have a yard or public way, which is a reasonable amount to provide the degree of independence intended and to provide fire department access. There is a need for this requirement as configurations of townhouses can create situations with a side that has a relatively small proportion of the wall length that has a yard or public way; for example, townhouses that are configured around the corner of a townhouse building per the drawing below.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal provides a clarification to the current code requirements so it should not increase or decrease the cost of construction.

RB22-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal has some good ideas, but needs further development. (Vote: 11-0)

Assembly Action: **None**

RB22-19

Individual Consideration Agenda

Public Comment 1:

IRC®: [RB] 202, R302.2

Proponents:
David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and has a yard or public way on not less than two sides ~~that extends at least 50 percent of the length of each of these two sides~~.

R302.2 Townhouses. <u>Townhouse units shall have a yard or public way on the entire projected length of one of the four principal sides and on at least two-thirds of the projected length of another principal side.</u> Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.

Commenter's Reason: The committee agreed there was a need to address the issue raised in the original proposal and requested that this come back at the public comment hearings. The intent of this public comment is to improve on the original proposal by addressing issues raised at the public comment hearings. This is accomplished as follows:
1. Many comments were made that requirements should not be in a definition. This public comment moves specific yard or public way requirements to the R302.2 Townhouses section and keeps the definition of townhouse as it currently is. An additional benefit to this approach is that the definition of townhouse in the IRC and the IBC remain to be very similar.

2. The original proposal required a yard or public way on a minimum of 50% of each open side. This is changed to the entire projected length of one principal side and at least two-thirds of the projected length of another side. Two-thirds is a compromise between the 50% originally proposed and the 80% proposed in a floor modification at the committee action hearings. The entire length of one side was added since it was pointed out that two partially open sides could result in a unit that is too "boxed in", creating more hazard from adjacent units than intended. I originally assumed one side would be fully open since this is the case almost all of the time, but configurations could have been used that reduced the openness on two sides.

3. Wording has changed from "length of sides" to "projected length of...principal sides". The intent is to avoid short jogs in the exterior wall from being counted as a "side". This is a major improvement over the current townhouse definition that only requires a yard or public way on two "sides", with no indication of what is considered to be a "side".

Please support this public comment to bring clarity to the openness requirements for townhouses. The current language in the code only requires a yard or public way on two sides with no minimum length requirements for the yards or public ways, making this largely open to interpretation. This public comment puts a hard requirement on the lengths of the yards or public ways which brings clarity and consistency for designers and building officials.

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 a clarification to the current code requirements so it should not increase or decrease the cost of construction.

Public Comment# 1343

Public Comment 2:

IRC®: [RB] 202, R302.2, R302.2.1 (New), R302.2.2 (New)

Proponents:
Jeffrey Shapiro, International Code Consultants, representing IIAR (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

[RB] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof ~~and has a yard or public way on not less than two sides that extends at least 50 percent of the length of each of these two sides~~.

R302.2 Townhouses. ~~Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2.~~

<u>**R302.2.1 Open sides and adjoining units.** Where a townhouse unit adjoins one or two other townhouse units, a yard or public way shall be provided on not less than two sides.</u>

Where a townhouse unit adjoins three or more other townhouse units, all of the following shall apply:

1. The townhouse unit and adjoining townhouse units shall be equipped with automatic fire sprinkler systems in accordance with Section P2904.
2. Not less than 25 percent of the perimeter of each townhouse unit shall adjoin a yard or public way, distributed on two or more open sides
3. To be considered an open side, the minimum length of exterior wall adjoining a yard or public way shall be 3 feet.

R302.2.2 Separation walls. Walls separating townhouse units shall be constructed in accordance with Section R302.2.2.1 or R302.2.2.2.

Commenter's Reason: This comment builds on a floor modification that was presented at the code hearing, which received significant support. The committee generally commented favorably on the approach, but viewed the modification as too much to digest on the fly at the hearing. Conceptually, the idea is pretty straightforward. It is to better recognize the original concept of townhouses, which was built on rectangular row houses in a linear configuration, and also accommodate fourplexes that are made up of 4 corner units in a square or rectangle. In each of these cases, any townhouse unit is exposed to not more than two neighboring units. Over time, townhouse designers have gotten very creative with the concept of "sides" that adjoin a yard or public way, and odd shapes that have townhouse units adjoining 3 or more neighboring units with a variety of common wall schemes have evolved. What constitutes a "side" in such cases has led to disagreements between code officials and designers, and lacking guidance in the code, code officials have little to fall back on beyond "I'm the code official," and that puts the code official in a bad situation.

This comment maintains the current approach for townhouses that adjoin one or two other units because, in such cases, jogged walls that might otherwise "block" part of an open side tend to be less of a problem based on simpler geometry. No harm, no foul...the only change made by the comment for such situations is moving the yard/public way text out of the definition and into the body of the code because the current text regarding open sides puts a regulation into the definition, which is frowned upon.

The issue of open sides becomes much more pronounced when three or more units share walls. The approach taken in this comment, which reflects what the committee considered in the floor modification, is to regulate based on a percentage of total unit perimeter being open to a yard or public way. The requirement for fire sprinklers, technically always required by the IRC but not enforced in some jurisdictions, is appropriate because the risk of exposure to an adjacent unit on fire increases by 50% or more when you step from 2 adjoining units to 3 or more. With sprinklers being provided, the need for large open sides is reduced, and the intent of this change is to allow one or more of the open sides to be as small as 3 feet. This correlates with RB86-19 (approved at the code hearing), which clarified that emergency escape and rescue openings require a minimum of 36-inches of clear space between the opening and a public way.

The 25% figure is derived from a typical 20x30 townhouse and follows the logic that the front side might be entirely open and the back side partially to mostly blocked by another unit or units. Remember, none of that applies to townhouses adjoining only one or two other units. It only kicks in where 3 or more units are adjoined, and a designer always has the option of adjoining only one or two other units to avoid the limit if it becomes a problem for a narrow townhouse.

Although there is no "perfect" fix to this issue given the multitude of configurations that designers might come up with, this comment provides a fair, reasonable and flexible basis for quantifying a level of openness for townhouses that should be acceptable given the history of the townhouse provisions and interests of today's designers.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Technically, the IRC requires all buildings to be sprinklered, so this doesn't have a cost impact with respect to the model code. In jurisdictions that amend the IRC by removing the sprinkler requirement, there would be a cost increase if the habitable attic provisions were used.

Public Comment# 2086

RB25-19

IRC®: (New)

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Add new definition as follows:

WATERPROOFING. Treatment of a surface or structure that bridges nonstructural cracks, and is designed to resist the passage of water under hydrostatic pressure or through capillary action, which may penetrate the building assembly.

Reason: Dampfroofing in Section R406.1 is no longer commonly used in the code knowledgeable industry, as it is not an effective way to keep the buildings below grade foundation system, dry, durable and free from moisture and mold issues affecting homes and homeowners today. The typical dampfroofing, system will require additional steps such as parging, or other materials be applied to the foundation wall prior to the application of the dampfroofing product. This adds additional costs in materials and labor for the builder. This cost is passed along to the consumer. Knowledgeable builders of today understand the benefits of waterproofing and the overall cost savings in initial costs, and the reduction in costs associated with call backs and repairs of wet foundation systems. Therefore it is necessary to define waterproofing

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase the cost of construction as it is simply correcting the definition for clarity reasons. In fact this clarity may even reduce the costs of the code from delays that happen when code corrections are written for a specific job or building by more clearly defining what the code means by, Waterproofing . These delays caused by code corrections costs the builders money.

RB25-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The reason statement mentions structural cracks, but there are also other types of cracks. A definition of waterproofing may be needed, but this needs more work. Not all terms need a definition. This is already very well covered in Section R406.2. This term is not commonly misunderstood. (Vote: 10-1)

Assembly Action: **None**

RB25-19

Individual Consideration Agenda

Public Comment 1:

IRC®: (New)

Proponents:
Ann Houske Jacklitch, representing AMBO IRC Code Committee (ajacklitch@maplegrovemn.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

WATERPROOFING. Treatment of a surface or structure that bridges ~~nonstructural~~ cracks, and is designed to resist the passage of water under hydrostatic pressure or through capillary action, which may penetrate the building assembly.

Commenter's Reason: Reference to the type of crack is unnecessary in the definition as there are many kinds of cracks. Whether structural or non-structural is immaterial; repairs to structural cracks are required to be completed prior to application of waterproofing. The committee cited R406.2 as providing definition of waterproofing, however, that section identifies where waterproofing is required and lists examples of waterproofing products.

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 will not increase the cost of construction as it is simply correcting the definition for clarity reasons.

Public Comment# 1526

RB30-19

IRC®: SECTION R202, 202, R301.1.4 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R202
DEFINITIONS

Add new text as follows:

INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

R301.1.4 Intermodal shipping containers. Intermodal shipping containers shall be designed in accordance with the structural provisions in Section 3114 of the International Building Code.

Reason: This code change purpose is to introduce intermodal shipping containers into the International Residential Code based on requests by code officials in the U.S. Prior to this proposal, several jurisdictions had created their own individual regulations or ordinances, or had administered additional requirements beyond the code (e.g. Section R104.11 "Alternative Materials, design and methods of construction and equipment") so at to be comfortable to ensure a safe structure. This code change proposal is in response to those requests to develop a provision in order to establish a consistent set of provisions which cover the minimum safety requirements, but which do not duplicate existing code provisions.
The proposed definition is consistent with the successful code change proposal to the International Building Code, new Section 3114. For consistency, we are introducing that same definition here.

The reference to the International Building Code has been modeled after Sections R301.1.1 through R301.1.3. The BCAC Shipping Container Working Group chose not to duplicate the newly accepted shipping container structural design language in the International Building Code. This proposal is making a simple reference the new section in the IBC where the provisions for shipping container structural safety are contained. As Section R301.1 applies to structural design only, the other non-structural provisions of the International Residential Code would apply as required (e.g. energy, plumbing, mechanical, electrical, etc.). Also, because Section R301.1.1 deals with primarily alternative sources of structural design (e.g. independent reference standard structural design resources outside the codes), the BCAC shipping container Working Group determined it to be more appropriate to separate this reference to the IBC for clarity.

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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on theBCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/building-code-action-committee-bcac/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will decrease the cost of construction. This new code section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for residential building construction. Current use of repurposed intermodal shipping containers requires the owner or builder to submit through the alternative means and methods administrative provisions.

RB30-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This should simply reference the IBC for intermodal shipping containers. These structures need to be engineered and don't belong in the IRC. (Vote: 8-3)

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IRC®: R301.1.4 (New)

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.1.4 Intermodal shipping containers. Intermodal shipping containers that are repurposed for use as buildings or structures, or as part of buildings or structures,shall be designed in accordance with the structural provisions in Section 3114 of the International Building Code.

Commenter's Reason: The IRC-B code development committee noted that the original proposal as written should be disapproved because:

- Shipping containers belong in the International Building Code.
- Performance based design required therefore does not belong in IRC.
- User can apply through the alternate means and methods provisions.
- The proposed language literally says nothing about utilizing shipping containers for structures and buildings.

We believe the arguments for an only IBC provision fall short as a result of comments brought to the shipping container task group's attention. One most notable finding was that there is still the belief that since the IRC does not address intermodal shipping containers that they are exempt from the IRC. Other comments received by the task group were views that since the containers are already designed and constructed to ISO specifications that there is no further need to design for use as dwellings. Both types of assumptions are not accurate. Therefore, it suggests a need for a direct reference.

Further, the shipping container task group has received compliments for proposing this language as it makes clear that said repurposed containers are in fact subject to the IBC structurally and the IRC for the remainder of the required code required attributes.

In regard to the perception that the proposed language falls short of identifying the utilization of shipping containers, we agree. In response we have modified the provision to address this short fall.

In view of the above, we recommend that this proposal be given consideration "as modified" at the fall ICC code hearings.

This public comment 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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

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 and pubic comment will decrease the cost of construction. This new section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for residential building construction. Current use of repurposed intermodal shipping containers requires the owner or builder to submit through the alternative means and methods administrative process.

Public Comment# 1247

RB33-19

IRC®: TABLE R301.2(1)

Proposed Change as Submitted

Proponents: Gil Rossmiller, representing Colorado Chapter ICC (gilrossmiller@coloradocode.net)

2018 International Residential Code

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW	WIND DESIGN				SEISMIC DESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM			~~WINTER DESIGN TEMP[e]~~	ICE BARRIER UNDERLAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEANANNUAL TEMP[j]
LOAD[o]	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Wind-bornedebris zone[m]		Weath -ering[a]	Frost line depth[b]	Termite[c]					
—	—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA[n]													
Elevation			Lattitud e	Winter heating	Summer cooling	Altitude correction factor[g]			Indoor design temperature	Design temperature cooling		Heating temperature difference	
—			—	—	—	—			—	—		—	
Cooling temperature difference			Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range			Winter humidity	Summer humidity		—	
—			—	—	—	—			—	—		—	

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(4). The grade of masonry un

b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.

c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.

d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(5)A]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.

e. ~~The outdoor design dry-bulb temperature shall be selected from the columns of 97$^{1}/_{2}$-percent values for winter from Appendix D of the International Plumbing Code. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the building official. [Also see Figure R301.2(1)~~

f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.

g. The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having jurisdiction, as amended.

h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."

i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

l. In accordance with Figure R301.2(5)A, where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.

o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figure R301.2(6).

p. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria as determined by the jurisdiction.

Reason: The overall change will help jurisdictions complete the manual J portion of the table and help plans examiners in completing reviews. The upper portion of the table remains unchanged, except for the removal of the "WINTER DESIGN TEMP[e]" column and footnote e. This currently creates a conflict within the table itself. Footnote e states the winter design temperature shall be selected from appendix D of the International Plumbing Code using the 97 ½ percent value. The Manual J portion states that the winter design come from table 1A which uses the 99 percent value. Removing the "WINTER DESIGN TEMP[e]" column and footnote e eliminates this conflict.

The Manual J portion has been reformatted to clarify the design parameters and removed default values. We will take each cell and explain:

Wind Velocity Heating: Deleted from table

This value is not found in table 1A or 1B of Manual J. The default value in Manual J is 7.5mph. This is also the default value used in all Manual J software. For those who have a Manual J (version two) the explanation is on page 177 and is reprinted here for all to review:

"The default values for wind velocity are 15 MPH for heating and 7 ½ MPH for cooling. These velocities do not represent the most severe wind conditions that will be experienced when the outdoor temperature is at the winter or summer design temperature, but they do represent values that are compatible with normal weather patterns. If a location has a reputation for wind velocities that consistently exceed these defaults during non-storm conditions, an appropriate set of velocity values may be substituted for the default values."

Wind Velocity Cooling: Deleted from table See reason above

Elevation: Unchanged

Altitude Correction Factor [o]: Added new footnote

Provides direction to the correct table in Manual J. This is the only value in the Manual J section that does not appear in table 1A or 1B

o. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

Summer design grains: New

This was added to help the plans examiner during plan review. This is a critical design perimeter as this the one of the values used to calculate the latent load (moisture) for cooling. This is the value that designers will change to increase (artificially) the latent load for cooling and therefore the need for larger equipment. This value is plainly seen in Manual J reports. We have provided two examples below and a portion of Manual J table 1A.

Indoor winter design relative humidity: Modified

Was labeled 'Winter humidity' and was assumed that this was indoor design relative humidity. This change makes it clear.

Indoor winter design temperature: Modified

Was labeled 'Indoor design temperature' and was assumed to be the winter design as it was under the "WINTER DESIGN TEMP[e]" column. With the above coulomb removed this change makes it clear the value should be the indoor winter design temperature.

Outdoor winter design temperature: Modified

Was labeled 'Winter heating' and was assumed that this was outdoor design temperature. This change makes it clear.

Heating temperature difference: Unchanged.

Latitude: Unchanged

Daily range: Unchanged

Coincident wet bulb: Unchanged

Indoor summer design relative humidity: Modified

Was labeled 'Summer humidity' and was assumed that this was the indoor design relative humidity. This change makes it clear.

Indoor summer design temperature: Modified

This was labeled as 'Design temperature cooling' and was assumed to be the indoor summer design temperature. This change makes it clear.

Cooling temperature difference: Unchanged

FOOTNOTES: The language of the footnotes remains unchanged. They were renumbered do to the removal of footnote e and a new footnote o.

Examples of a completed Manual J Table:

FOR DENVER, COLORADO

TABLE R301.2(1)

CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[a]	WIND DESIGN				SEISMIC DESIGN CATEGORY[e]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[g]	FLOOD HAZARDS[f]	AIR FREEZING INDEX[h]	MEAN ANNUAL TEMP[i]
	Speed[d] (mph)	Topographic Effects[j]	Special wind Region[k]	Windborne debris zone[l]		Weathering[a]	Frost line depth[b]	Termite[c]				
—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA[m]												
Elevation		Altitude correction factor [o]		Summer design grains	Indoor winter design relative humidity	Indoor winter design temperature			Outdoor winter design temperature	Heating temperature difference		
5283		0.84		-33 to -48	30%	70°			-3°	73°		
Latitude		Daily range		Coincident wet bulb	Indoor summer design relative humidity	Indoor summer design temperature			Outdoor summer design temperature	Cooling temperature difference		
39		H		59°	50%	75°			90°	15°		

FOR St. AUGUSTINE, FLORIDA

TABLE R301.2(1)

CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[n]	WIND DESIGN				SEISMIC DESIGN CATEGORY[e]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[g]	FLOOD HAZARDS[f]	AIR FREEZING INDEX[h]	MEAN ANNUAL TEMP[i]
	Speed[d] (mph)	Topographic Effects[j]	Special wind Region[k]	Windborne debris zone[l]		Weathering[a]	Frost line depth[b]	Termite[c]				
—	—	—	—	—	—	—	—	—	—	—	—	—

MANUAL J DESIGN CRITERIA[m]

Elevation	Altitude correction factor [o]	Summer design grains	Indoor winter design relative humidity	Indoor winter design temperature	Outdoor winter design temperature	Heating temperature difference
10	1.00	59 to 72	30%	70°	35°	35°
Latitude	**Daily range**	**Coincident wet bulb**	**Indoor summer design relative humidity**	**Indoor summer design temperature**	**Outdoor summer design temperature**	**Cooling temperature difference**
29	M	78°	50%	75°	89°	15°

PORTION OF TABLE 1A FROM ACCA MANUAL J

Table 1A

Outdoor Design Conditions for the United States

Location	Elevation	Latitude	Winter	Summer					
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M

As you can see from the tables above there is a large difference in the design grains from a dry climate like Denver, Colorado and humid climate like St. Augustine, Florida. You can also see from table 1A that depending on your indoor relative humidity design the design grains change. The key for reviewers is not to get stuck on an exact number, but to know that dry climates will always have a negative number and humid climates will have a positive number.

PARTIAL MANUAL J REPORT FROM WRIGHTSOFT SOFTWARE

Design Conditions

Location:

Denver, CO, US
Elevation: 5331 ft
Latitude: 40°N

Outdoor:	**Heating**	**Cooling**
Dry bulb (°F)	-3	90
Daily range (°F)	-	27 (H)
Wet bulb (°F)	-	59
Wind speed (mph)	15.0	7.5

Indoor:	**Heating**	**Cooling**
Indoor temperature (°F)	70	75
Design TD (°F)	73	15
Relative humidity (%)	30	50
Moisture difference (gr/lb)	35.3	-35.9

Infiltration:

Method	Simplified
Construction quality	Average
Fireplaces	0

PARTIAL MANUAL J REPORT FROM ELITE SOFTWARE

Design Data		
Reference City:		Denver, Colorado
Building Orientation:		Front door faces Southeast
Daily Temperature Range:		High
Latitude:	39	Degrees
Elevation:	5830	ft.
Altitude Factor:	0.807	
Elevation Sensible Adj. Factor:	1.000	
Elevation Total Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-3	-3.7	80%	30%	70	35.77
Summer:	90	59	17%	50%	75	-37

The two reports above are both for Denver, Colorado and both are correct and yet you see the Grains Difference are not the same. This value will vary slightly depending on the weather data within the software. Again, small differences will not change the calculation significantly.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The revised table will not increase the heating or cooling loads. It may help for more accurate load calculations, therefore smaller equipment and possible reduced costs.

RB33-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The winter design temperature should not be removed. The reason statement does not correspond with the graphic. The proposal needs to protect solar systems from freezing as required under M2301.2.6 and protect pipes from freezing in Sections P2603.5 and P3001.2. (Vote: 11-0)

Assembly Action: **None**

RB33-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R301.2(1)

Proponents:
Gil Rossmiller, representing Colorado Chapter, ICC (gilrossmiller@coloradocode.net)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

GROUND SNOW LOADo	WIND DESIGN				SEISMICDESIGN CATEGORY[f]	SUBJECT TO DAMAGE FROM			~~WINTER DESIGN TEMP~~[e]	ICE BARRIER UNDERLAYMENT REQUIRED[h]	FLOOD HAZARDS[g]	AIR FREEZING INDEX[i]	MEAN ANNUAL TEMP[j]
	Speed[d] (mph)	Topographic effects[k]	Special wind region[l]	Wind-borne debris zone[m]		Weathering[a]	Frost line depth[b]	Termite[c]					
—	—	—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIA[n]													
Elevation			~~Lattitude~~ Altitude correction factor[e]	~~Winterheating~~ Coincident wet bulb	~~Summer cooling~~ Indoor winter design relative humidity	~~Altitude correction factor~~ Indoor winter design dry-bulb temperature			~~Indoor design temperature~~	~~Design temperature cooling~~ Outdoor winter design dry-bulb temperature		Heating temperature difference	
—			—	—	—	—			—	—		—	
~~Cooling temperature difference~~ Latitude			~~Wind velocity heating~~ Daily range	~~Wind velocitycooling~~ Summer design grains	~~Coincident wet bulb~~ Indoor summer design relative humidity	~~Daily range~~ Indoor summer design dry-bulb temperature			~~Winter humidity~~	~~Summer humidity~~ Outdoor summer design dry-bulb temperature		Cooling temperature difference	
—			—	—	—	—			—	—		—	

For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, "negligible," "moderate" or "severe" for concrete as determined from Figure R301.2(4). The grade of masonry units shall be determined from ASTM C34, C55, C62, C73, C90, C129, C145, C216 or C652.

b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.

c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.

d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(5)A]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.

e. ~~The outdoor design dry-bulb temperature shall be selected from the columns of 97 ½ -percent values for winter from Appendix D of the International Plumbing Code. Deviations from the Appendix D temperatures shall be permitted to reflect local climates or local weather experience as determined by the building official. [Also see Figure R301.2(1).]~~ The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.

f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.

g. The jurisdiction shall fill in this part of the table with (a) the date of the jurisdiction's entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having jurisdiction, as amended.

h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1 and R905.8.3.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall fill in this part of the table with "NO."

i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table "Air Freezing Index-USA Method (Base 32°F)."

k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with "YES." Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

l. In accordance with Figure R301.2(5)A, where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with "YES" and identify any specific requirements. Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate "NO" in this part of the table.

n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.

o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figure R301.2(6).

Commenter's Reason:
Committee Action was for disapproval

Published committee reason:

Committee Reason: The winter design temperature should not be removed. The reason statement does not correspond with the graphic. The proposal needs to protect solar systems from freezing as required under M2301.2.6 and protect pipes from freezing in Sections P2603.5 and P3001.2. (Vote: 11-0)

The major reason the committee was confused was that the proposal that I approved was not published in the monograph correctly. This was my fault in not reviewing what was published in the monograph, which was completely wrong. The proposal as revised (and originally) only referenced Manual J for the winter design temperature rather than the current conflict with the plumbing code. See my reason statement.

The overall change will help jurisdictions complete the manual J portion of the table and help plans examiners in completing reviews.

Currently the table has two different outdoor winter design dry-bulb temperatures. Creating a conflict within the table itself.
The upper portion of the table remains unchanged, except for the removal of the "WINTER DESIGN TEMP[e]" column and footnote e. Footnote e states the winter design temperature shall be selected from appendix D of the International Plumbing Code using the 97 ½ percent value.
The Manual J portion states that the winter design comes from table 1A which uses the 99 percent value. Removing the "WINTER DESIGN TEMPe" column and footnote e eliminates this conflict. The Manual J portion of the table has been reformatted to clarify the design parameters and removes default values. We will take each cell and explain:

Wind Velocity Heating: Deleted from table

This value is not found in table 1A or 1B of Manual J. The default value in Manual J is 15 mph. This is also the default value used in all Manual J software. For those who have a Manual J (version two) the explanation is on page 177 and is reprinted here for all to review

"The default values for wind velocity are 15 MPH for heating and 7 ½ MPH for cooling. These velocities do not represent the most severe wind conditions that will be experienced when the outdoor temperature is at the winter or summer design temperature, but they do represent values that are compatible with normal weather patterns. If a location has a reputation for wind velocities that consistently exceed these defaults during non-storm conditions, an appropriate set of velocity values may be substituted for the default values."

Wind Velocity Cooling: Deleted from table. See reason above

Elevation: Unchanged

Altitude Correction Factor[e] : Added and revised footnote [e]

Provides direction to the correct table in Manual J. This value does not appear in table 1A or 1B of Manual J.
e. <u>The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.</u>

Summer design grains: New

This was added to help the plans examiner during plan review. This is a critical design parameter as this is one of the values used to calculate the latent load (moisture) for cooling. Designers will change this value to increase (artificially) the latent load for cooling and therefore the need for larger equipment. This value is plainly seen in Manual J reports. We have provided two examples below and a portion of Manual J table 1A.

Indoor winter design relative humidity: Modified

This cell was originally labeled 'Winter humidity' and was assumed that this was indoor design relative humidity. This change makes it clear that the value is the indoor winter design relative humidity.

Indoor winter design dry-bulb temperature: Modified

This cell was originally labeled 'Indoor design temperature' and was assumed to be the indoor winter design dry-bulb temperature as it was under the "WINTER DESIGN TEMPe" column. With the "WINTER DESIGN TEMPe" column removed this change makes it clear the value is the indoor winter design dry-bulb temperature.

Outdoor winter design dry-bulb temperature: Modified

This cell was originally labeled 'Winter heating' and was assumed that this was outdoor design dry-bulb temperature. This change makes it clear the value is the outdoor winter design dry-bulb temperature .

Heating temperature difference: Unchanged. Just relocated in the table

Latitude: Unchanged. Just relocated in the table

Daily range: Unchanged. Just relocated in the table

Coincident wet bulb: Unchanged. Just relocated in the table

Indoor summer design relative humidity: Modified

This cell was originally labeled 'Summer humidity' and was assumed that this was the indoor design relative humidity. This change makes it clear the value is the indoor summer design relative humidity.

Indoor summer design dry-bulb temperature: Modified

This cell was originally labeled as 'Design temperature cooling' and was assumed to be the indoor summer design dry-bulb temperature. This change makes it clear the value is the indoor summer design dry-bulb temperature.

Outdoor summer design dry-bulb temperature: Modified

This cell was originally labeled 'Summer Cooling' and was assumed to be the outside dry-bulb design temperature. This change makes it clear the value is the outdoor summer design dry-bulb temperature.

Cooling temperature difference: Unchanged. Just relocated

Footnotes: Except for footnote [e] all other footnotes remain unchanged.

Examples of a completed Manual J table as proposed by the public comment and screen shots from Manual J table 1A:

For St. AUGUSTINE, FLORIDA

Table 1A
Outdoor Design Conditions for the United States

Location	Elevation	Latitude	Winter	Summer						
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M

TABLE R301.2(1)

CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[n]	WIND DESIGN				SEISMIC DESIGN CATEGORY[e]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[g]	FLOOD HAZARDS[f]	AIR FREEZING INDEX[h]	MEAN ANNUAL TEMP[i]
	Speed[d] (mph)	Topographic Effects[j]	Special wind Region[k]	Windborne debris zone[l]		Weathering[a]	Frost line depth[b]	Termite[c]				
—	—	—	—	—	—	—	—	—	—	—	—	—

MANUAL J DESIGN CRITERIA[m]						
Elevation	Altitude correction factor[e]	Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature	Outdoor winter design dry-bulb temperature	Heating temperature difference
10	1.00	78°	30%	70°	35°	35°
Latitude	Daily range	Summer design grains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature	Outdoor summer design dry-bulb temperature	Cooling temperature difference
29	M	59 to 72	50%	75°	89°	16°

For DENVER, COLORADO

Table 1A
Outdoor Design Conditions for the United States

Location	Elevation	Latitude	Winter	Summer						
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)	
Colorado										
Alamosa AP	7543	37	-11	82	55	-53	-46	-40	H	
Boulder	5385	40	0	91	59	-47	-40	-34	H	
Colorado Springs AP	6171	38	4	87	58	-46	-39	-33	H	
Craig	6283	40	-12	85	56	-52	-45	-39	H	
Denver AP	5283	39	-3	90	59	-46	-39	-33	H	

TABLE R301.2(1)

CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD[n]	WIND DESIGN				SEISMIC DESIGN CATEGORY[e]	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED[g]	FLOOD HAZARDS[f]	AIR FREEZING INDEX[h]	MEAN ANNUAL TEMP[i]
	Speed[d] (mph)	Topographic Effects[j]	Special wind Region[k]	Windborne debris zone[l]		Weathering[a]	Frost line depth[b]	Termite[c]				
—	—	—	—	—	—	—	—	—	—	—	—	—

MANUAL J DESIGN CRITERIA[m]						
Elevation	Altitude correction factor[e]	Coincident wet bulb	Indoor winter design relative humidity	Indoor winter design dry-bulb temperature	Outdoor winter design dry-bulb temperature	Heating temperature difference
5283	0.84	59°	30%	70°	-3°	73°
Latitude	Daily range	Summer design grains	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature	Outdoor summer design dry-bulb temperature	Cooling temperature difference
39	H	-33 to -48	50%	75°	90°	15°

As you can see from the tables above there is a large difference in the design grains from a dry climate like Denver, Colorado and humid climate like St. Augustine, Florida. You can also see from table 1A that depending on your indoor relative humidity design the design grains change. The key for reviewers is not to get stuck on an exact number, but to know that dry climates will always have a negative number and humid climates will have a positive number.

PARTIAL MANUAL J REPORT FROM WRIGHTSOFT SOFTWARE

Design Conditions

Location:
Denver, CO, US
Elevation: 5331 ft
Latitude: 40°N

Outdoor:	**Heating**	**Cooling**
Dry bulb (°F)	-3	90
Daily range (°F)	-	27 (H)
Wet bulb (°F)	-	59
Wind speed (mph)	15.0	7.5

Indoor:	**Heating**	**Cooling**
Indoor temperature (°F)	70	75
Design TD (°F)	73	15
Relative humidity (%)	30	50
Moisture difference (gr/lb)	35.3	-35.9

Infiltration:

Method	Simplified
Construction quality	Average
Fireplaces	0

PARTIAL MANUAL J REPORT FROM ELITE SOFTWARE

Design Data		
Reference City:		Denver, Colorado
Building Orientation:		Front door faces Southeast
Daily Temperature Range:		High
Latitude:	39	Degrees
Elevation:	5830	ft.
Altitude Factor:	0.807	
Elevation Sensible Adj. Factor:	1.000	
Elevation Total Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	-3	-3.7	80%	30%	70	35.77
Summer:	90	59	17%	50%	75	-37

The two reports above are both for Denver, Colorado and both are correct and yet you see the Grains Difference are not the same. This value will vary slightly depending on the weather data within the software. Again, small differences will not change the calculation significantly.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The revised table will not increase the heating or cooling loads. It may help for more accurate load calculations, therefore smaller equipment and possible reduced costs.

Public Comment# 1286

RB40-19

IRC®: 202 (New), R301.2.2.6

Proposed Change as Submitted

Proponents: Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (KCobeen@wje.com); Julie Furr, Rimkus Consulting Group, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (jfurr@rimkus.com); Michael Mahoney, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

2018 International Residential Code

Add new definition as follows:

CRIPPLE WALL CLEAR HEIGHT. The vertical height of a *cripple wall* from the top of the foundation to the underside of floor framing above.

Revise as follows:

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D_0, D_1 and D_2 and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through ~~7~~ 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

   Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

   1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   2. The ratio of the back span to the cantilever is not less than 2 to 1.
   3. Floor joists at ends of *braced wall panels* are doubled.
   4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and $1^{1}/_{2}$ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
   5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

   Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.

3. Shear wall or braced wall offsets in plane. Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

   Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

   1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
   2. The header is composed of:
      2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
      2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
      2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
   3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
5. Floor level offset. Conditions where portions of a floor level are vertically offset.

   Exceptions:

   1. Framing supported directly by continuous foundations at the perimeter of the building.
   2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.

6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.
7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

   Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

   8. Hillside Light-Frame Construction. Light-frame construction in which both Items 1 and 2 below apply:
   8.1 The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and
   8.2 The tallest *cripple wall clear height* exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".

   Exception : Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Reason: As part of work contributing to FEMA P-1100 (Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings Volume 1 - Prestandard), it was identified that for light-frame dwellings on steep hillsides (Figure 1), adequate seismic performance does not occur when seismic design is based on typical seismic force distribution assumptions (tributary area, flexible diaphragm). Whether loading is in the cross-slope or out-of-hill direction (Figure 2), seismic forces follow the stiffest load path to the uphill foundation, rather than distributing uniformly to all the bracing walls in the way assumed in development of IRC seismic bracing provisions. For this reason, design using the IRC bracing provisions will not provide adequate seismic performance. This change proposal triggers an engineered lateral force design for hillside dwellings by adding the hillside dwelling configuration to the already existing list of configurations deemed to be irregular for seismic design purposes.
This dwelling configuration was illustrated to be vulnerable in the 1994 Northridge, California Earthquake. The Earthquake Spectra Northridge Earthquake Reconnaissance Report (Volume 2, EERI, 1996) reported 117 significantly damaged hillside dwellings of the bearing wall type and 40 of the post and beam (stilt) type. Fifteen dwellings were reported to have collapsed or were so near collapse that they were immediately demolished and another fifteen came close to collapsing. HUD (1994) also reported significant damage to hillside dwellings. As examples of vulnerable hillside dwelling performance, Figure 3 illustrates a dwelling that pulled about six inches away from the uphill foundation, but did not collapse, and Figure 4 illustrates one of the collapsed dwellings.

Blaney et. Al (2018), illustrates results from numerical studies used in development of FEMA P-1100. Figure 18 of this reference indicates that for a studied hillside dwelling, the probability of collapse in the risk-adjusted maximum considered earthquake (MCE_R) was reduced by more than a factor of seven by changing from typical prescriptive bracing practice to an engineered methodology that considered the seismic response. More background on dwelling past performance and the numerical studies are found in FEMA P-1100.

The Item 1 grade slope trigger is used to limit applicability of this irregularity to dwellings that are on sites with a significant slope (Figure 5). Averaging the grade slope along the side of the dwelling is intended to focus on the overall drop in grade elevation across the dwelling and not trigger the irregularity based only on limited areas of higher grade slope. This is consistent with the numerical studies that form the basis of this proposal. For most dwellings this criterion will be evaluated by looking at each of the four primary elevations. For large and more complex dwellings, additional “sides” will need to be evaluated.

Item 2 adds a second trigger of downhill cripple wall height greater than 7’-0” (Figure 6) or downhill post clear height in post and pier dwelling (Figure 7) based on the FEMA P-1100 numerical studies. Both Items 1 and 2 need to be triggered in order to qualify for dwelling to be qualified as irregular. These triggers were observed to be the points at which damage and displacements at the uphill foundation were thought to significantly increase the likelihood of collapse.

The exception scopes out of irregularity Item 8 dwellings that have full-height concrete or masonry walls (Figure 8) because this configuration was not part of the numerical studies that form the basis of this proposal. For a dwelling with a simple rectangular floor plan, full height concrete or masonry walls would need to occur on three sides to qualify for the exception. For a more complex dwelling plan configuration, additional concrete or masonry walls would be required to qualify for the exception. Dwellings with doors and windows in the concrete or masonry walls still qualify for the exception. In all dwellings the concrete or masonry walls will need to conform to applicable IRC provisions.

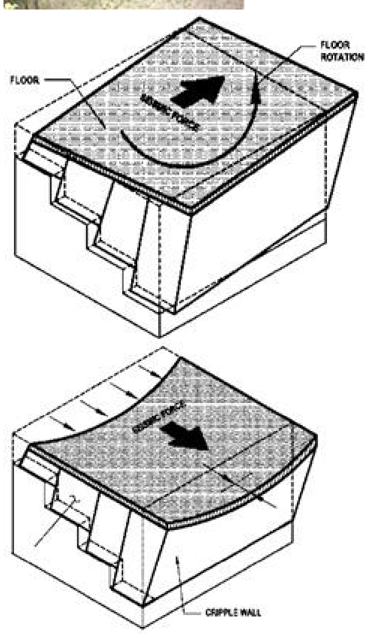


Figure 1 Hillside light-frame structure. Figure 2. Hillside structure cross-slope and out-of-hill loading.

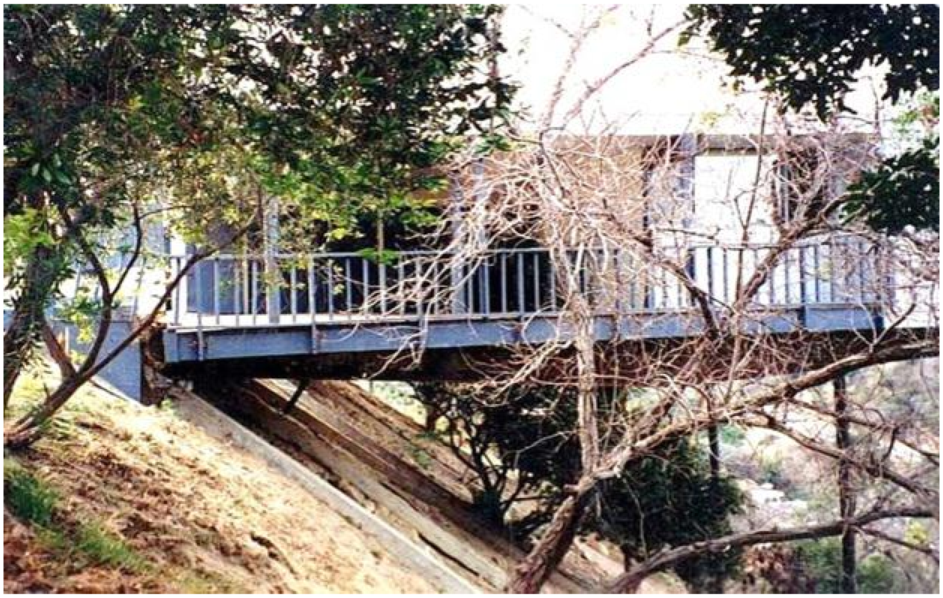


Figure 3. Hillside dwelling pulled away from uphill foundation in the 1994 Northridge, California Earthquake (Credit: City of Los Angeles Department of Building and Safety). Red arrow shows location where floor framing has pulled six to eight inches away from the uphill foundation.

Figure 4. Hillside dwelling collapsed in the 1994 Northridge, California Earthquake (Credit: City of Los Angeles Department of Building and Safety).

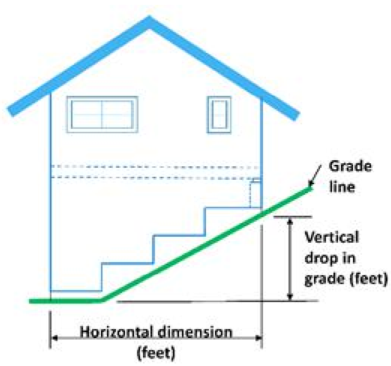


Figure 5. Grade slope triggering the hillside dwelling irregularity exceeds 1 vertical in 5 horizontal across the full width of any side of the dwelling.

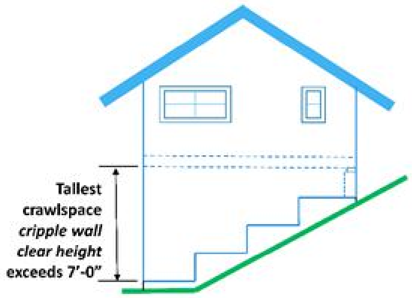


Figure 6. Downhill cripple wall height triggering the hillside dwelling irregularity.

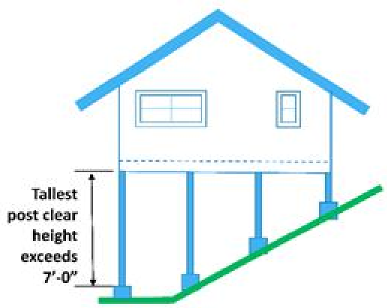


Figure 7. Downhill post height triggering the hillside dwelling irregularity.

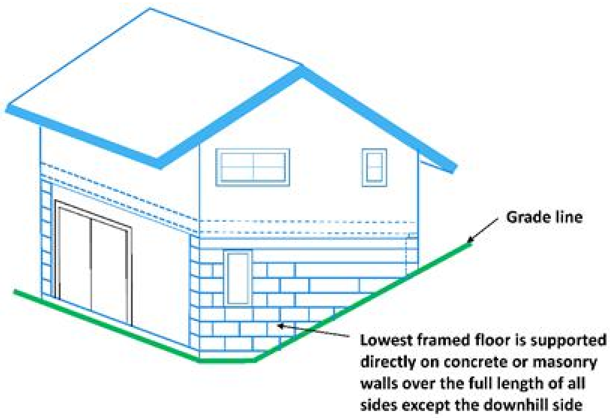


Figure 8. Concrete or masonry wall configuration that does not tripper the hillside dwelling irregularity.

Bibliography: FEMA, 2018. *Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings Volume 1 - Prestandard (FEMA P-1100)*, Federal Emergency Management Agency, Washington, DC.
Blaney et. Al., 2018. “Prestandard for Seismic Assessment and Retrofit of One- and Two-Family Dwellings (FEMA P-1100, ATC-110 Project),” *Proceedings of the 2018 SEAOC Convention*, SEAOC, Sacramento, CA.

EERI, 1996. 1994 Northridge California Earthquake. The Earthquake Spectra Northridge Earthquake Reconnaissance Report, EERI, Oakland, CA.

HUD, 1994. Performance of HUD-Assisted Properties During the January 17, 1994 Northridge Earthquake, U.S. Department of Housing and Urban Development, Washington, D.C.

Cost Impact: The code change proposal will increase the cost of construction
This proposal is anticipated to increase the number of dwellings required to have an engineered lateral force design for moderately steep to very steep sites. In regions where these dwellings are believed to already be predominantly engineered, the cost impact is thought to be negligible. In other regions where these dwellings are not predominantly engineered, additional costs will be incurred for engineered design and more robust anchorage to the foundation.

RB40-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R301.2.2.6..............

8. Hillside Light-Frame Construction. Conditions in which all of the following apply: ~~Light frame construction in which both Items 1 and 2 below apply:~~

8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and

8.2. The tallest *cripple wall clear height* exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".

8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including the foundation.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Committee Reason: Structures on sloped lots do not currently have adequate design parameters. The modification corrects the indents for Item 8 and revises the first sentence of Item 8 to address the addition of Item 8.3. (Vote: 11-0)

Assembly Action: **None**

RB40-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R301.2.2.6

Proponents:
Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D_0, D_1 and D_2 and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

   Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

   1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   2. The ratio of the back span to the cantilever is not less than 2 to 1.
   3. Floor joists at ends of *braced wall panels* are doubled.
   4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and $1^1/_2$ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
   5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

   Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.

3. Shear wall or braced wall offsets in plane. Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

   Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

   1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
   2. The header is composed of:
      2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
      2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
      2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
   3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
5. Floor level offset. Conditions where portions of a floor level are vertically offset.

   Exceptions:

   1. Framing supported directly by continuous foundations at the perimeter of the building.
   2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.

6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.
7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

   Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. Hillside Light-Frame Construction. Conditions in which all of the following apply:

8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and

8.2. The tallest *cripple wall clear height* exceeds 7'-0", or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".

8.3. Of the total plan area below the lowest framed door, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including connections to the foundation and design of the foundation to transfer lateral loads from the framing above.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Commenter's Reason: The purpose of this public comment is to focus the engineered analysis of foundations triggered by the presence of the hillside home irregularity on the anchorage of light-frame crawlspace or basement walls and light-frame floor diaphragms above to a concrete or masonry foundation wall and the transfer of lateral forces through that anchorage to the foundation and to the soil.
As written, the description of the elements to be designed could be taken to include engineered design of concrete and masonry foundations walls for out-of-plane soil forces in addition to the lateral forces from the light-frame structure above. This may lead to such foundation walls needing to be designed for higher soil pressures per IBC Table 1610.1. In addition, out-of-plane seismic soil pressures may need to be applied. The results can be increased wall thickness, greater amounts of reinforcing, and larger footings (with accompanying reinforcing), significantly driving up the cost of construction.

The FEMA P-1100 prestandard on which RB40 is based focuses on concerns with light-frame wall anchorage to foundations and the transfer of those lateral loads. It discusses the need for insuring foundation elements to have the proper width and depth to accommodate retrofit anchors and have the minimum necessary concrete strength and quality to support the loads from the retrofit anchors. P-1100 does not raise concerns about other facets of foundation wall construction and design, especially not resistance to out-of-plane soil loads.

This clarification is consistent with the general intent of Section R301.2.2.6 that the level of engineered design undertaken to address an irregularity is only needed to the extent the irregularity affects the performance of the structural system. Clearly, the issue addressed by this new irregularity is the capacity of the dwelling's seismic force-resisting system, not the effects of soil pressure on the foundation walls.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As noted by the proponents, where the new irregularity applies the cost of construction may increase due to engineering fees and additional shear wall, floor diaphragm, floor anchorage and foundation wall costs. The public comment, if approved, would mitigate some of the cost increase by avoiding unnecessary design for out-of-plane soil loads beyond that required by the basic IRC provisions, and thus additional concrete or masonry wall and footing thickness and reinforcing not otherwise needed to address the hillside home irregularity itself.

Public Comment# 1363

Public Comment 2:

IRC®: R301.2.2.6

Proponents:
Shane Nilles, representing Self (snilles@cityofcheney.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in Seismic Design Categories C, D_0, D_1 and D_2 and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

1. **Shear wall or braced wall offsets out of plane.** Conditions where exterior shear wall lines or *braced wall panels* are not in one plane vertically from the foundation to the uppermost story in which they are required.

   Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support *braced wall panels* that are out of plane with *braced wall panels* below provided that all of the following are satisfied:

   1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
   2. The ratio of the back span to the cantilever is not less than 2 to 1.
   3. Floor joists at ends of *braced wall panels* are doubled.
   4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and $1^1/_2$ inches (38 mm) wide fastened with six 16d nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.
   5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or *braced wall lines* on all edges.

   Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or *braced wall line*.

3. Shear wall or braced wall offsets in plane. Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

   Exception: For wood light-frame wall construction, one end of a *braced wall panel* shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

   1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
   2. The header is composed of:
      2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.
      2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
      2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
   3. The entire length of the *braced wall panel* does not occur over an opening in the wall below.

4. Floor and roof opening. Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.

5. Floor level offset. Conditions where portions of a floor level are vertically offset.

   Exceptions:

   1. Framing supported directly by continuous foundations at the perimeter of the building.
   2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.

6. Perpendicular shear wall and wall bracing. Conditions where shear walls and *braced wall lines* do not occur in two perpendicular directions.

7. Wall bracing in stories containing masonry or concrete construction. Conditions where stories above *grade plane* are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

   Exception: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. Hillside Light-Frame Construction. Conditions in which all of the following apply:
   8.1. The grade slope exceeds 1 vertical in 5 horizontal where averaged across the full length of any side of the dwelling, and

   8.2. The tallest *cripple wall clear height* exceeds 7'-0" . ~~, or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7'-0".~~

   8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50% is *living space* having interior wall finishes conforming to Section R702.

   Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor diaphragm immediately above the cripple walls ~~or post and beam system~~ and all structural elements and connections from this diaphragm down to and including the foundation.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

Commenter's Reason: The original proposal modification does not take into account that all "floor system post or pier foundations" supporting braced wall panels are required to be designed in accordance with engineering practices per R602.10.9. If the proposal is accepted as it is currently written, it will a conflicting provisions where it will imply that those hill-side buildings that have post and beam support systems where the posts do not exceed 7' in height are not required to be engineered whereas R602.10.9 does require it regardless of the height of the posts. This would result in buildings being built with less consideration for the structural concerns that the proposal is intending to address. This public comment corrects this conflict while maintaining the intent of the proposal.

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 modification does not increase or decrease the cost of construction beyond that of the original proposal.

Public Comment# 2142

RB43-19

IRC®: R301.3

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, National Association of Home Builders, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).
Exception: A story height not exceeding 13 feet 7 inches is permitted provided the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or Exception 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10.
2. For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).
3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).
Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.
4. For insulating concrete form walls, the maximum story height shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per *story* as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).
5. For structural insulated panel (SIP) walls, the story height shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per *story* as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, Individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6 ~~provisions~~, provided that the *story heights* of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code .

Reason: The purpose of this code change is to finally address a long-standing conflict and point of confusion in the IRC story height provisions and restore the original intent of the IRC.
In the 2003 through 2006 IRC, the default provisions of Section R301.3 specified wood-frame buildings could have a maximum bearing wall stud height of 10 feet supporting framing members not exceeding 16” in depth. An exception allowed a maximum bearing wall stud height of 12 feet provided an engineered design for the wall and studs was provided for everything other than the wall bracing for wind and seismic loads, which could be determined per Section R602.10 with adjustment factors to increase the bracing amounts for the higher walls.

For the 2009 IRC, a successful proposal from SBCA revised Section R301.3 to allow floor framing members (e.g. I-joists or trusses) deeper than 16” to be used if the bearing wall stud height was less than 10 feet. This was accomplished by specifying an overall story height limit of 11’-7”, or the sum of a 10’-0” tall stud, 2x top and bottom plates, and 16” deep framing.

This technically overrode the exception allowing bearing wall studs up to 12 feet with wall bracing per the Section R602.10 adjustment factors and engineering design otherwise, not to mention conflicting with the 12 foot bearing wall height limit for masonry walls and additional 8 feet allowed for gable end walls. However, to our recollection this was not brought up in floor testimony, committee discussion, or in public comments, and the change passed.

For the 2015 IRC, the BCAC further revised this section by deleting the 11’-7” story height limit from the final paragraph of Section R301.3 and placing it in each of the individual items to which it applied. This addressed the conflict with masonry walls but still did not fix the conflict with Section R602.10. To make matters worse, former members of the ICC Ad-Hoc Wall Bracing Committee advanced a proposal to delete the entire exception for bearing wall studs up to 12 feet out of a concern code users would double-count the multipliers on the wall bracing, which are reflected in the respective tables of adjustment factors for wind and seismic bracing. Neither the BCAC nor the former AHC-WB members provided a fix for the conflict between the story height limits and the wall bracing provisions.

For the 2018 IRC, NAHB added the new Table R602.3(6) allowing bearing wall studs up to 12 feet in height for limited cases. We still did not directly address the conflict between the story height limits and the wall bracing provisions, let alone the conflict with the new table. In essence, NAHB (and others modifying Section R301.3) have relied on the statement in the last paragraph that invididual walls or wall studs could exceed the limits of R301.3 as long as overall story heights were not exceeded.

This proposal generally restores the exception present in the 2000 through 2012 IRC stating “the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind and seismic force resisting systems" provided R602.10 is complied with, including mandated increases for stud heights up to 12 feet. At the same time, language is added pointing to the two exceptions to 10 foot bearing wall heights under Section R602.3, including the exception leading to the new Table R602.3(6). This will provide a critical link to both exceptions that is currently missing in the 2018 IRC. The requirement to use engineering design for studs in these tall walls not otherwise complying with one of the two exceptions to Section R602.3 is maintained.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change will not increase cost for builders in jurisdictions making a jump from the 2006 IRC or earlier directly to the 2021 IRC. The code change will also not increase cost for builders using subsequent editions and interpreting the language allowing individual walls or wall studs to exceed the limits of Section R301.3 to permit certain walls (e.g. foyers, great rooms, garages) to exceed the 11'-7" story height limit provided the average story height remains within the limit. The code change may decrease the cost of construction for builders who have been forced to hire structural engineers to design the lateral force-resisting system for houses with 11 or 12 foot bearing walls that would have met the 2000 through 2006 IRC but were excluded from the structural provisions of the IRC due to a strict interpretation of the language in the 2009 IRC and subsequent editions.

RB43-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Wind load factors need to be addressed before this proposal is moved forward. The committee hopes that the parties involved can get together and propose a public comment to resolve this issue. (Vote: 8-3)

Assembly Action: **None**

RB43-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R301.3

Proponents:
Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with *story heights* not exceeding the following:

1. For wood wall framing, the *story height* shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

   Exception: A story height not exceeding 13 feet 7 inches is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or Exception 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10. <u>Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.</u>

2. For cold-formed steel wall framing, the *story height* shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).
3. For masonry walls, the *story height* shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

   Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

4. For insulating concrete form walls, the maximum story height shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per *story* as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).

5. For structural insulated panel (SIP) walls, the story height shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per *story* as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, Individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6 , provided that the *story heights* of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the *story height* limits of this section are exceeded, the design of the building, or the noncompliant portions thereof, to resist wind and seismic loads shall be in accordance with the International Building Code .

Commenter's Reason: The primary reason RB43 was disapproved was due to concerns raised as to whether the calculations for the adjustments to Chapter 6 wall bracing amounts for bearing walls over 10 feet but not exceeding 12 feet included the depth of floor framing in the wall height or considered it separately and in addition to the bearing wall height.
NAHB was a member of the ICC Ad-Hoc Wall Bracing Committee and worked closely with the committee members who developed the wind bracing calculations. As such, NAHB has access to a copy of the spreadsheet used to generate the calculations. An extract from the portion of the spreadsheet where bracing amounts are calculated is included with this proposal. In the upper left hand corner of the extract, there is a yellow box for users of the spreadsheet to enter site data and building geometry. A close look at the items of building geometry can be entered reveals there is an box for entering floor framing depth separately from the wall stud height, and that the framing depth was set to one foot for calculating the Table R602.10.3(1) wind bracing amounts. It is noted the adjustment factors in Table R602.10.3(2) were calculated manually by separately running the wind bracing analysis for different building geometries (e.g. increasing the wall height) and comparing the results to determine the factors.

It is noted the story height limits in Section R301.3 are based on a 16" framing depth. However, the IRC is limited to three stories above grade plane, and therefore the difference between the Section R602.10 bracing assumptions and what Section R301.3 would permit is 8 inches. One would be hard pressed to argue an 8 inch difference will significantly compromise building performance in any way.

Members of the ATC/FEMA Seismic Code Support Committee expressed some concern over the need to make sure the top of the wall studs were properly braced by the floor and roof framing and diaphragms in the dwelling. Of particular concern were cases where the roof assembly had a cathedral or vaulted ceiling, so the framing and ceiling diaphragm were diagonal at the intersection with the wall. At the SCSC's request, NAHB agreed to add a sentence to the current provision in Section R602.3 that requires studs be continuous from a foundation or floor diaphragm below to a floor, roof or ceiling diaphragm above. That provision has been in the IRC since 2009 and would apply to the wall studs covered by RB43, but it certainly does no harm to re-emphasize the need for proper lateral support at the top of the studs.

As no other reasons were raised in opposition other than the confusion over the wind bracing assumptions, the committee action should be overturned and RB43 approved as submitted. This will allow us to finally fix the disconnect between Chapter 3 and Chapter 6 that has persisted for 4 code cycles and make this area of the IRC easier to interpret and enforce.

3. Bracing amounts are based on load and resistance values from sheets 1 and 2.

Yellow shading indicates a user input cell

Site Data		
Basic Wind Speed:	115	mph (based on ASCE 7-10, Figure 26.5-1A for Risk Cat II Buildin
Exposure/Height Factor,	1	(from ASCE 7-10, Figure 28.6-1 based on Site Exposure and Me
Topographic Factor Kzt:	1	(from ASCE 7-10, Section 26.8)
Importance Factor, I:	1	(use 1.0 for ASCE 7-10; importance factor addressed by mapped
ASD Wind Load Factor:	0.6	(from ASCE 7-10, Section 2.4)
Building Geometry		
Roof Ridge Height:	10	ft (vertical distance from eave to ridge)
Wall Height:	10	ft (floor-to-ceiling)
Floor Depth:	1	ft
End Zone Parameter, a:	4	ft (from ASCE 7-10, Figure 28.6-1)

Number of braced wall lines: 1.00 <--- enter 1.0 for 2, enter 1.3 for 3 and so on (see

Required Length of Wall Bracing for Wind Speed Using ASCE 7-1**

Stories above Braced Wall Line	Roof Slope	Braced Wall Line Spacing	Factored ASD Required Shear Force at BWL	115 MPH IRC Bracing Methods: LIB, GB	DWB, WSP,WFB,PBS ,PSP,HPS,CS-SFB	CS-WSP, CS-G,CS-PF
	*Adjusted Unit Shear Strength:			240 plf.	420 plf.	420 plf.
Roof Only	6:12 and Less	10 ft.	621 lbs.	2.6 ft.	1.5 ft.	1.3 ft.
		15 ft.	891 lbs.	3.7 ft.	2.1 ft.	1.8 ft.
		20 ft.	1,153 lbs.	4.8 ft.	2.7 ft.	2.3 ft.
		25 ft.	1,410 lbs.	5.9 ft.	3.4 ft.	2.9 ft.
		30 ft.	1,665 lbs.	6.9 ft.	4.0 ft.	3.4 ft.
		35 ft.	1,917 lbs.	8.0 ft.	4.6 ft.	3.9 ft.
		40 ft.	2,169 lbs.	9.0 ft.	5.2 ft.	4.4 ft.
		45 ft.	2,420 lbs.	10.1 ft.	5.8 ft.	4.9 ft.
		50 ft.	2,671 lbs.	11.1 ft.	6.4 ft.	5.4 ft.
		55 ft.	2,921 lbs.	12.2 ft.	7.0 ft.	5.9 ft.
		60 ft.	3,172 lbs.	13.2 ft.	7.6 ft.	6.4 ft.
	Greater than 6:12 to 12:12	10 ft.	830 lbs.	3.5 ft.	2.0 ft.	1.7 ft.
		15 ft.	1,201 lbs.	5.0 ft.	2.9 ft.	2.4 ft.
		20 ft.	1,553 lbs.	6.5 ft.	3.7 ft.	3.1 ft.
		25 ft.	1,898 lbs.	7.9 ft.	4.5 ft.	3.8 ft.
		30 ft.	2,240 lbs.	9.3 ft.	5.3 ft.	4.5 ft.
		35 ft.	2,580 lbs.	10.7 ft.	6.1 ft.	5.2 ft.
		40 ft.	2,918 lbs.	12.2 ft.	6.9 ft.	5.9 ft.
		45 ft.	3,255 lbs.	13.6 ft.	7.8 ft.	6.6 ft.
		50 ft.	3,592 lbs.	15.0 ft.	8.6 ft.	7.3 ft.
		55 ft.	3,929 lbs.	16.4 ft.	9.4 ft.	8.0 ft.
		60 ft.	4,265 lbs.	17.8 ft.	10.2 ft.	8.6 ft.
	* Adjusted Unit Shear Strength:			240 plf.	420 plf.	420 plf.
Roof plus One Story	6:12 and Less	10 ft.	1,451 lbs.	6.0 ft.	3.5 ft.	2.9 ft.
		15 ft.	2,080 lbs.	8.7 ft.	5.0 ft.	4.2 ft.
		20 ft.	2,678 lbs.	11.2 ft.	6.4 ft.	5.4 ft.
		25 ft.	3,262 lbs.	13.6 ft.	7.8 ft.	6.6 ft.
		30 ft.	3,838 lbs.	16.0 ft.	9.1 ft.	7.8 ft.
		35 ft.	4,411 lbs.	18.4 ft.	10.5 ft.	8.9 ft.
		40 ft.	4,981 lbs.	20.8 ft.	11.9 ft.	10.1 ft.
		45 ft.	5,550 lbs.	23.1 ft.	13.2 ft.	11.2 ft.
		50 ft.	6,117 lbs.	25.5 ft.	14.6 ft.	12.4 ft.
		55 ft.	6,683 lbs.	27.8 ft.	15.9 ft.	13.5 ft.
		60 ft.	7,249 lbs.	30.2 ft.	17.3 ft.	14.7 ft.
		10 ft.	1,603 lbs.	6.7 ft.	3.8 ft.	3.2 ft.
		15 ft.	2,317 lbs.	9.7 ft.	5.5 ft.	4.7 ft.
		20 ft.	2,997 lbs.	12.5 ft.	7.1 ft.	6.1 ft.

7/18/2019

gs)
an Roof Height)
wind speed MRI)

footnote b)

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INTERMITTENT & CONTINUOUS BRACING ANALYSIS PARAMETERS

Partial Restraint Factors			
Methods:	1&5	2,3,4,6,7,8	*Cont. Shtg.
Roof Only	1.2	1.2	1.2
Roof + 1sty	1.2	1.2	1.2
Roof+2sty	1.2	1.2	1.2
Whole Building System Effect Factor:		Int. Braces 1	Cont. Shtg. 1

Note: The system effect is based directly on whole building tests and does not include contribution of interior partitions (conservative). (See "BRANZ" and "CSIRO" tabs for verification)

(JHC, 3/31/08)

Partial Restraint and System Factor Values Based on: -- SEE "BRANZ Verification" and "CSIRO Verification" tabs for specific verificatio

1. Liu, Ni, Rainer, Wensheng (2006), "Effect of upper story on the Performance of Wood Shear Walls", WCTE, Portland, OR
   (0.8 factor and 0.95 factor based on results for large garage opening wall supporting nothing and floor + wall above without roof dea
2. Dolan and Pryor (12/11/2006), "A Preliminary Report on Effect of Various Boundary Conditions..." for ASTM E2126 Subcommittee
   (provides additional basis for 0.8 factor for wall supporting roof system only based on relevant results for BC 3 and BC 5)
3. Thurston (2002), "Full-Sized House Cyclic Racking Test", Study Report No. 119 (2003), BRANZ, New Zealand
4. Thurston (2007), "Maximum wall bracing rating that is compatible with NZS 3604 Construction", Study Report No. 163, BRANZ, New :
   (references 3 & 4 justify 1.0 partial restraint for 400 plf nominal bracing value)
   (reference 3 justifies system effect of 1.6, excluding contribution of interior partitions when only braced wall panels are counted at fu
5. HUD (2001). Whole Structure Testing - Three Reports, See also Paevre (CSIRO) Masters Thesis and Crandell (2006) WDF article "
   (ref 1 and 5 justify 1.6 system factor for continuous and intermittent sheathing systems; further confirmed by CUREe/FEMA test -- se

* **Note:** The continuous sheathing bracing amounts are also multiplied by 0.8 or 0.9 depending on max opening clear height.
For example, if a continuous sheathed wall supporting a roof only has a maximum size opening with 65%
clear opening height (a window), the net partial restraint factor and continuous sheathed factor
would be effectively 0.8 x 1/0.8 = 1.0 (e.g., bracing would be considered as fully restrained).
Thus, the 700 plf bracing method is fully utilized (not reduced for partial restraint) when continuous sheathing is used.

Summarized Results (for >6:12 roof)

Required Length of Wall Bracing for Wind

Stories above Braced Wall Line	Braced Wall Line Spacing	115 MPH IRC Bracing Methods LIB, GB	115 MPH IRC Bracing Methods DWB, WSP,WFB,PBS,PSP,HPS,CS SFB	115 MPH IRC Bracing Methods CS-WSP, CS-G,CS-PF	
Roof Only	10 ft.	3.5	2.0	1.7	
	15 ft.	5.0	2.9	2.4	
	20 ft.	6.5	3.7	3.1	
	25 ft.	7.9	4.5	3.8	
	30 ft.	9.3	5.3	4.5	
	35 ft.	10.7	6.1	5.2	
	40 ft.	12.2	6.9	5.9	
	45 ft.	13.6	7.8	6.6	
	50 ft.	15.0	8.6	7.3	
	55 ft.	16.4	9.4	8.0	
	60 ft.	17.8	10.2	8.6	
Roof plus One Story	10 ft.	6.7	3.8	3.2	
	15 ft.	9.7	5.5	4.7	
	20 ft.	12.5	7.1	6.1	
	25 ft.	15.3	8.7	7.4	
	30 ft.	18.0	10.3	8.7	
	35 ft.	20.7	11.8	10.1	
	40 ft.	23.4	13.4	11.4	
	45 ft.	26.2	14.9	12.7	
	50 ft.	28.9	16.5	14.0	
	55 ft.	31.6	18.0	15.3	
	60 ft.	34.3	19.6	16.6	
Roof plus Two Stories	10 ft.	9.9	5.7	4.8	
	15 ft.	14.3	8.2	6.9	
	20 ft.	18.5	10.6	9.0	
	25 ft.	22.6	12.9	11.0	
	30 ft.	26.7	15.2	13.0	
	35 ft.	30.7	17.6	14.9	
	40 ft.	34.7	19.9	16.9	
	45 ft.	38.8	22.1	18.8	
	50 ft.	42.8	24.4	20.8	
	55 ft.	46.8	26.7	22.7	
	60 ft.	50.8	29.0	24.7	

TABULATION FOR ASCE 7-10 UPDATE OF 2012 IRC TABLE R602.10.3(1)

Required Length of Wall Bracing for Wind

Stories above Braced Wall Line	Braced Wall Line Spacing	110 MPH IRC Bracing Methods LIB, GB	110 MPH IRC Bracing Methods DWB, WSP,WFB,PBS,PSP,HPS,CS SFB	110 MPH IRC Bracing Methods CS-WSP, CS-G,CS-PF	115 MPH IRC Bracing Methods LIB, GB	115 MPH IRC Bracing Methods DWB, WSP,WFB,PBS,PSP,HPS,CS SFB
Roof Only	10 ft.	3.2	1.8	1.5	3.5	2.0
	15 ft.	4.6	2.6	2.2	5.0	2.9
	20 ft.	5.9	3.4	2.9	6.5	3.7
	25 ft.	7.2	4.1	3.5	7.9	4.5
	30 ft.	8.5	4.9	4.1	9.3	5.3
	35 ft.	9.8	5.6	4.8	10.7	6.1
	40 ft.	11.1	6.4	5.4	12.2	6.9
	45 ft.	12.4	7.1	6.0	13.6	7.8
	50 ft.	13.7	7.8	6.7	15.0	8.6
	55 ft.	15.0	8.6	7.3	16.4	9.4
	60 ft.	16.3	9.3	7.9	17.8	10.2
Roof plus One Story	10 ft.	6.1	3.5	3.0	6.7	3.8
	15 ft.	8.8	5.0	4.3	9.7	5.5
	20 ft.	11.4	6.5	5.5	12.5	7.1
	25 ft.	14.0	8.0	6.8	15.3	8.7
	30 ft.	16.5	9.4	8.0	18.0	10.3
	35 ft.	19.0	10.8	9.2	20.7	11.8
	40 ft.	21.5	12.3	10.4	23.4	13.4
	45 ft.	23.9	13.7	11.6	26.2	14.9
	50 ft.	26.4	15.1	12.8	28.9	16.5
	55 ft.	28.9	16.5	14.0	31.6	18.0
	60 ft.	31.4	17.9	15.2	34.3	19.6
Roof plus Two Stories	10 ft.	9.1	5.2	4.4	9.9	5.7
	15 ft.	13.1	7.5	6.4	14.3	8.2
	20 ft.	16.9	9.7	8.2	18.5	10.6
	25 ft.	20.7	11.8	10.0	22.6	12.9
	30 ft.	24.4	13.9	11.9	26.7	15.2
	35 ft.	28.1	16.1	13.6	30.7	17.6
	40 ft.	31.8	18.2	15.4	34.7	19.9
	45 ft.	35.5	20.3	17.2	38.8	22.1
	50 ft.	39.1	22.4	19.0	42.8	24.4
	55 ft.	42.8	24.4	20.8	46.8	26.7
	60 ft.	46.4	26.5	22.6	50.8	29.0

	Greater than 6:12 to 12:12	25 ft.	3,662 lbs.	15.3 ft.	8.7 ft.	7.4 ft.	
		30 ft.	4,321 lbs.	18.0 ft.	10.3 ft.	8.7 ft.	
		35 ft.	4,975 lbs.	20.7 ft.	11.8 ft.	10.1 ft.	
		40 ft.	5,628 lbs.	23.4 ft.	13.4 ft.	11.4 ft.	
		45 ft.	6,278 lbs.	26.2 ft.	14.9 ft.	12.7 ft.	
		50 ft.	6,927 lbs.	28.9 ft.	16.5 ft.	14.0 ft.	
		55 ft.	7,576 lbs.	31.6 ft.	18.0 ft.	15.3 ft.	
		60 ft.	8,224 lbs.	34.3 ft.	19.6 ft.	16.6 ft.	
Roof plus Two Stories	* Adjusted Unit Shear Strength:			**240 plf.**	**420 plf.**	**420 plf.**	
	6:12 and Less	10 ft.	2,281 lbs.	9.5 ft.	5.4 ft.	4.6 ft.	
		15 ft.	3,268 lbs.	13.6 ft.	7.8 ft.	6.6 ft.	
		20 ft.	4,202 lbs.	17.5 ft.	10.0 ft.	8.5 ft.	
		25 ft.	5,113 lbs.	21.3 ft.	12.2 ft.	10.3 ft.	
		30 ft.	6,012 lbs.	25.1 ft.	14.3 ft.	12.2 ft.	
		35 ft.	6,905 lbs.	28.8 ft.	16.4 ft.	14.0 ft.	
		40 ft.	7,793 lbs.	32.5 ft.	18.6 ft.	15.8 ft.	
		45 ft.	8,679 lbs.	36.2 ft.	20.7 ft.	17.6 ft.	
		50 ft.	9,563 lbs.	39.8 ft.	22.8 ft.	19.4 ft.	
		55 ft.	10,445 lbs.	43.5 ft.	24.9 ft.	21.1 ft.	
		60 ft.	11,326 lbs.	47.2 ft.	27.0 ft.	22.9 ft.	
	Greater than 6:12 to 12:12	10 ft.	2,375 lbs.	9.9 ft.	5.7 ft.	4.8 ft.	
		15 ft.	3,434 lbs.	14.3 ft.	8.2 ft.	6.9 ft.	
		20 ft.	4,440 lbs.	18.5 ft.	10.6 ft.	9.0 ft.	
		25 ft.	5,426 lbs.	22.6 ft.	12.9 ft.	11.0 ft.	
		30 ft.	6,402 lbs.	26.7 ft.	15.2 ft.	13.0 ft.	
		35 ft.	7,371 lbs.	30.7 ft.	17.6 ft.	14.9 ft.	
		40 ft.	8,337 lbs.	34.7 ft.	19.9 ft.	16.9 ft.	
		45 ft.	9,301 lbs.	38.8 ft.	22.1 ft.	18.8 ft.	
		50 ft.	10,263 lbs.	42.8 ft.	24.4 ft.	20.8 ft.	
		55 ft.	11,223 lbs.	46.8 ft.	26.7 ft.	22.7 ft.	
		60 ft.	12,183 lbs.	50.8 ft.	29.0 ft.	24.7 ft.	

* Adjusted unit shear strength is based on nominal values (see "resistance tab") adjusted by 2.0 safety factor and partial restraint tabulated above.

** Required Wall Bracing Amounts are determined by dividing ASD required shear force (Tab 1. Load x ASD load factor) by adjusted unit shear strength and then dividing the result by system effect factor tabulated above.

Summarized Results (Benchmarking)

Required Length of Wall Bracing for Wind					
Stories above Braced Wall Line	Braced Wall Line Spacing	115 MPH			
		Intermittent Braces		Continuous Sheathing	
		LIB, GB	DWB, WSP,WFB,PBS,PSP,HPS,CS SFB	CS-WSP, CS-G,CS-PF	
Roof Only	10 ft.	3 ft.	1 ft.	1 ft.	
	15 ft.	4 ft.	2 ft.	2 ft.	
	20 ft.	5 ft.	3 ft.	2 ft.	
	25 ft.	6 ft.	3 ft.	3 ft.	
	30 ft.	7 ft.	4 ft.	3 ft.	
	35 ft.	8 ft.	5 ft.	4 ft.	
	40 ft.	9 ft.	5 ft.	4 ft.	
	45 ft.	10 ft.	6 ft.	5 ft.	
	50 ft.	11 ft.	6 ft.	5 ft.	
	55 ft.	12 ft.	7 ft.	6 ft.	
	60 ft.	13 ft.	8 ft.	6 ft.	
Roof plus One Story	10 ft.	6 ft.	3 ft.	3 ft.	
	15 ft.	9 ft.	5 ft.	4 ft.	
	20 ft.	11 ft.	6 ft.	5 ft.	
	25 ft.	14 ft.	8 ft.	7 ft.	
	30 ft.	16 ft.	9 ft.	8 ft.	
	35 ft.	18 ft.	11 ft.	9 ft.	
	40 ft.	21 ft.	12 ft.	10 ft.	
	45 ft.	23 ft.	13 ft.	11 ft.	
	50 ft.	25 ft.	15 ft.	12 ft.	
	55 ft.	28 ft.	16 ft.	14 ft.	
	60 ft.	30 ft.	17 ft.	15 ft.	
Roof plus Two Stories	10 ft.	10 ft.	5 ft.	5 ft.	
	15 ft.	14 ft.	8 ft.	7 ft.	
	20 ft.	18 ft.	10 ft.	9 ft.	
	25 ft.	21 ft.	12 ft.	10 ft.	
	30 ft.	25 ft.	14 ft.	12 ft.	
	35 ft.	29 ft.	16 ft.	14 ft.	
	40 ft.	32 ft.	19 ft.	16 ft.	
	45 ft.	36 ft.	21 ft.	18 ft.	
	50 ft.	40 ft.	23 ft.	19 ft.	
	55 ft.	44 ft.	25 ft.	21 ft.	
	60 ft.	47 ft.	27 ft.	23 ft.	

Benchmarking Conditions (from above inputs):		
# of stories:	2-story	
wind speed:	115	mph
exposure:	B	
wall height:	10	ft
ridge-eave ht:	10	ft
roof pitch:	<6:12	

TABLE NOTES (subject to further simplifications):

(NOTE: Use of tabulated bracing amounts are further limited by 1 BWP at 25'oc)

1. Wind exposure B and a 30' mean roof height. For other conditions, multiply required bracing length by one of the following factors:

No. of Stories in Bldg	Mean Roof, ht h	Exposure/Height Factors, λ Exp B	Exp C
1	15	1.0	1.2
2	22.5	1.0	1.3
3	30	1.0	1.4

n details

d load applied, respectively)

Zealan

ll-restrained nominal values)
The Story Behind IRC Bracing Provisions"
ee BRANZ, CSIRO, and CUREe/FEMA tabs)

	120 MPH			130 MPH			140 MPH		
	IRC Bracing Methods			IRC Bracing Methods			IRC Bracing Methods		
CS-WSP, CS-G,CS-PF	LIB, GB	DWB, WSP,WFB,PBS,PSP,HPS,CS-SFB	CS-WSP, CS-G,CS-PF	LIB, GB	DWB, WSP,WFB,PBS,PSP,HPS,CS-SFB	CS-WSP, CS-G,CS-PF	LIB, GB	DWB, WSP,WFB,PBS,PSP,HPS,CS-SFB	CS-WSP, CS-G,CS-PF
1.7	3.8	2.2	1.8	4.4	2.5	2.1	5.1	2.9	2.5
2.4	5.4	3.1	2.6	6.4	3.7	3.1	7.4	4.2	3.6
3.1	7.0	4.0	3.4	8.3	4.7	4.0	9.6	5.5	4.7
3.8	8.6	4.9	4.2	10.1	5.8	4.9	11.7	6.7	5.7
4.5	10.2	5.8	4.9	11.9	6.8	5.8	13.8	7.9	6.7
5.2	11.7	6.7	5.7	13.7	7.8	6.7	15.9	9.1	7.7
5.9	13.2	7.6	6.4	15.5	8.9	7.5	18.0	10.3	8.8
6.6	14.8	8.4	7.2	17.3	9.9	8.4	20.1	11.5	9.8
7.3	16.3	9.3	7.9	19.1	10.9	9.3	22.2	12.7	10.8
8.0	17.8	10.2	8.7	20.9	12.0	10.2	24.3	13.9	11.8
8.6	19.3	11.1	9.4	22.7	13.0	11.0	26.3	15.0	12.8
3.2	7.3	4.2	3.5	8.5	4.9	4.1	9.9	5.7	4.8
4.7	10.5	6.0	5.1	12.3	7.0	6.0	14.3	8.2	6.9
6.1	13.6	7.8	6.6	16.0	9.1	7.7	18.5	10.6	9.0
7.4	16.6	9.5	8.1	19.5	11.1	9.5	22.6	12.9	11.0
8.7	19.6	11.2	9.5	23.0	13.1	11.2	26.7	15.2	13.0
10.1	22.6	12.9	11.0	26.5	15.1	12.9	30.7	17.6	14.9
11.4	25.5	14.6	12.4	30.0	17.1	14.6	34.8	19.9	16.9
12.7	28.5	16.3	13.8	33.4	19.1	16.2	38.8	22.2	18.8
14.0	31.4	18.0	15.3	36.9	21.1	17.9	42.8	24.4	20.8
15.3	34.4	19.6	16.7	40.3	23.1	19.6	46.8	26.7	22.7
16.6	37.3	21.3	18.1	43.8	25.0	21.3	50.8	29.0	24.7
4.8	10.8	6.2	5.2	12.6	7.2	6.1	14.7	8.4	7.1
6.9	15.6	8.9	7.6	18.3	10.4	8.9	21.2	12.1	10.3
9.0	20.1	11.5	9.8	23.6	13.5	11.5	27.4	15.7	13.3
11.0	24.6	14.1	12.0	28.9	16.5	14.0	33.5	19.1	16.3
13.0	29.0	16.6	14.1	34.1	19.5	16.6	39.5	22.6	19.2
14.9	33.4	19.1	16.2	39.2	22.4	19.1	45.5	26.0	22.1
16.9	37.8	21.6	18.4	44.4	25.4	21.6	51.5	29.4	25.0
18.8	42.2	24.1	20.5	49.5	28.3	24.1	57.4	32.8	27.9
20.8	46.6	26.6	22.6	54.6	31.2	26.5	63.4	36.2	30.8
22.7	50.9	29.1	24.7	59.8	34.1	29.0	69.3	39.6	33.7
24.7	55.3	31.6	26.8	64.9	37.1	31.5	75.2	43.0	36.5

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Consistent with the original reason statement, the code change and public comment will not increase cost where builders and building officials have interpreted the code to allow individual walls or wall studs exceeding the 11'-7" limit provided the average story height remains within the limit. The code change may decrease the cost of construction for builders who have been forced to hire structural engineers to design portions of homes with bearing wall studs over 10 feet but not exceeding 12 feet. Estimates from Home Innovation Research Labs of the cost to retain a structural engineer to design the lateral system for a house ranged from $436 to $750.

RB46-19

IRC®: TABLE R301.5

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)

USE	LIVE LOAD
Uninhabitable attics without storage[b]	10
Uninhabitable attics with limited storage[b, g]	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks[e]	40
Fire escapes	40
Guards ~~and handrails~~ ~~[d]~~[i]	200[h,i]
Guard in-fill components[f]	50[h]
Handrails [d]	200[h]
Passenger vehicle garages[a]	50[a]
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40[c]

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2, 1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.
d. A single concentrated load applied in any direction at any point along the top.
e. See Section R507.1 for decks attached to exterior walls.
f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
2. The slopes of the joists or truss bottom chords are not greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.

h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.
i. For a guard system not required to serve as a handrail, a single concentrated load applied at any point along the top, in the vertical downward direction and in the horizontal direction toward the lower surface. For a guard also serving as a handrail, a single concentrated load applied in any direction at any point along the top.

Reason: The purpose of this proposal is to revise the load on guard systems for one- and two-family dwellings to align with common industry practice. Extensive discussion has occurred in recent code cycles on load requirements and details for guard systems on decks accessory to one- and two-family dwellings. In particular, the directions in which the 200 pound guard load needs to be applied has been a topic of debate.
The IRC and IBC define a guard as “a building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.” The ASCE definition of a guardrail system is very similar. Clearly, a fall from the edge of an unprotected deck to the ground, which can be as much as 10 feet or more, carries a much greater risk of injury than a fall backwards onto the surface of the deck, which is only a few feet.

Further, a guard system can be constructed without a handrail, as under both the IRC and IBC a handrail is only required at a flight of stairs, a ramp, a stepped aisle, or a ramped aisle. Nor is the top rail of a guard system required to be graspable by occupants of a deck or other elevated walking surface, unless the guard is specifically designed to also serve as a handrail. In fact, a guard need not even have a top rail unless specifically required by the codes or the reference standards for guard systems, or desired as part of the design of the guard system.

As such, industry standards such as ASTM D7032 for wood and plastic composite decks boards and guards (referenced in both the IBC and IRC) and code evaluation acceptance criteria such as ICC-ES AC 174 for deck boards and guardrails, call for applying the 200 pound load in the outward and downward directions only, not inward or upward and certainly not parallel to the guard. Despite this apparent deviation from the IRC, IBC and ASCE 7 load requirements, thousands of guard systems, when designed, tested, and constructed in accordance with these industry standards and acceptance criteria and used properly, have performed exceptionally well and have protected occupants of decks against falls from the deck.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change will recognize existing practices in the design and testing of guard systems as specified in ASTM D7032, ICC-ES AC 174 and other industry standards for guard systems and components. Manufacturers with existing products designed and tested to those standards will remain compliant with the IRC and will not need to conduct additional engineering or testing. If this change is not approved, manufacturers may eventually be required to test or design their products for additional load directions, which would substantially increase cost.

RB46-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposed code text confuses what is already in the code. This should be coordinated with ASCE 7. Residential is not so different from commercial. (Vote: 7-4)

Assembly Action: **None**

RB46-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R301.5

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)

USE	LIVE LOAD
Uninhabitable attics without storage[b]	10
Uninhabitable attics with limited storage[b, g]	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks[e]	40
Fire escapes	40
Guards [i]	200[h,i]
Guard in-fill components[f]	50[h]
Handrails [d]	200[h]
Passenger vehicle garages[a]	50[a]
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40[c]

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm^2, 1 pound = 4.45 N.

a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.

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

c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.

d. A single concentrated load applied in any direction at any point along the top.

e. See Section R507.1 for decks attached to exterior walls.

f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.

g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
2. The slopes of the joists or truss bottom chords are not greater than 2 inches vertical to 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.

h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.

i. ~~For~~ Where the top of a guard system is not required to serve as a handrail, ~~a~~ the single concentrated load shall be applied at any point along the top, in the vertical downward direction and in the horizontal direction away from the walking ~~toward the lower~~ surface. ~~For~~ Where the top of a guard is also serving as the ~~a~~ handrail, a single concentrated load shall be applied in any direction at any point along the top. Concentrated load shall not be applied concurrently.

Commenter's Reason: The purpose of this public comment is to clarify the intent of the new footnote while preserving the original sense of the BCAC and the Deck Code Coalition that the critical directions of fall against which a guard provides protection are horizontally outward from the

adjacent walking surface and vertically downward towards a lower surface. “Guard system” is changed to “guard” consistent with the rest of the IRC. The footnote is revised to specify the application of the 200# load using “shall be applied” consistent with other footnotes to Table R301.5. Finally, a note that the specified directions of loading are to be considered separately, not concurrently. These revisions
Concerns have been raised about the effect over time of occupants pulling inward (or upward) on the guard and causing the post connection to loosen. Proposal RB185-19 from the Deck Code Coalition, which was approved by the IRC-Building committee, introduces a set of general minimum requirements for guard post attachments to deck framing. These requirements include, among other criteria, a minimum 4x4 post size, a prohibition on notching of posts, and a prohibition on connections relying solely on use of fasteners in end grain withdrawal. Just the latter provision alone will require guard post connections to deck framing use a combination of fasteners loaded in shear and withdrawal, reducing the risk of working loose the connectors loaded in withdrawal. The prohibition on notching reduces the risk of a split developing in the post that could grow larger with repeated loading.

Given that several industry standards or acceptance criteria require testing only in the horizontal outward and vertical downward directions, and given the IRC provides clear guidance on where a handrail is required, the BCAC believes the committee is incorrect that this change introduces confusion. In fact, it reduces confusion and aids enforcement by extending the principle – already recognized by the IRC – that guards and handrails serve different purposes, and by correlating the IRC with established ASTM standards, ICC acceptance criteria, and common practice throughout the residential and deck-building industry.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is intended as a clarification of requirements.

Public Comment# 1354

RB53-19

IRC®: R302.1, [RB] 202

Proposed Change as Submitted

Proponents: David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

2018 International Residential Code

Revise as follows:

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings*, *townhouses* and accessory buildings shall comply with Table R302.1(1); or *dwellings* and *townhouses* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling* or *townhouse* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings or *townhouses* on the *lot*.

The distance shall be measured at a right angle from the face of the wall.

Reason: Prior to the 2015 IRC, Section R302.2 required each townhouse to be considered a separate building and be separated by fire-resistance-rated walls meeting requirements for exterior walls, with an exception to provide a fire-resistance-rated common wall. The 2015 IRC revised this section to only deal with common walls and a reference to exterior walls was removed. Since R302.1 only requires fire-resistance-rated exterior walls for *dwellings* and accessory buildings, all townhouse exterior wall requirements were essentially removed from the code since a townhouse does not meet the definition of a *dwelling*. Prior to 2015 IBC, an imaginary line would be established between each townhouse since they were considered separate buildings and fire separation distance would be measured to the imaginary line, and it is believed that most juristictions still enforce this way.

This proposal brings back the 2012 townhouse exterior wall requirements that are assumed to have been inadvertently removed from the code. It does this by adding townhouses to the scoping of R302.1 for exterior walls and by revising the definition of fire separation distance to include imaginary lines between townhouses (rather than calling townhouses separate buildings, which they are not). Townhouse exterior walls that are adjacent to lot lines would meet exterior wall requirements based on fire separation distance to the lot lines. Townhouse exterior walls that are adjacent to other townhouses, would meet exterior wall requirements based on fire separation distance to the imaginary line between two townhouses. See Figures 1 and 2 below for application examples for this proposal. This proposal is necessary to fill the current hole in the code regarding exterior wall requirements for townhouses.

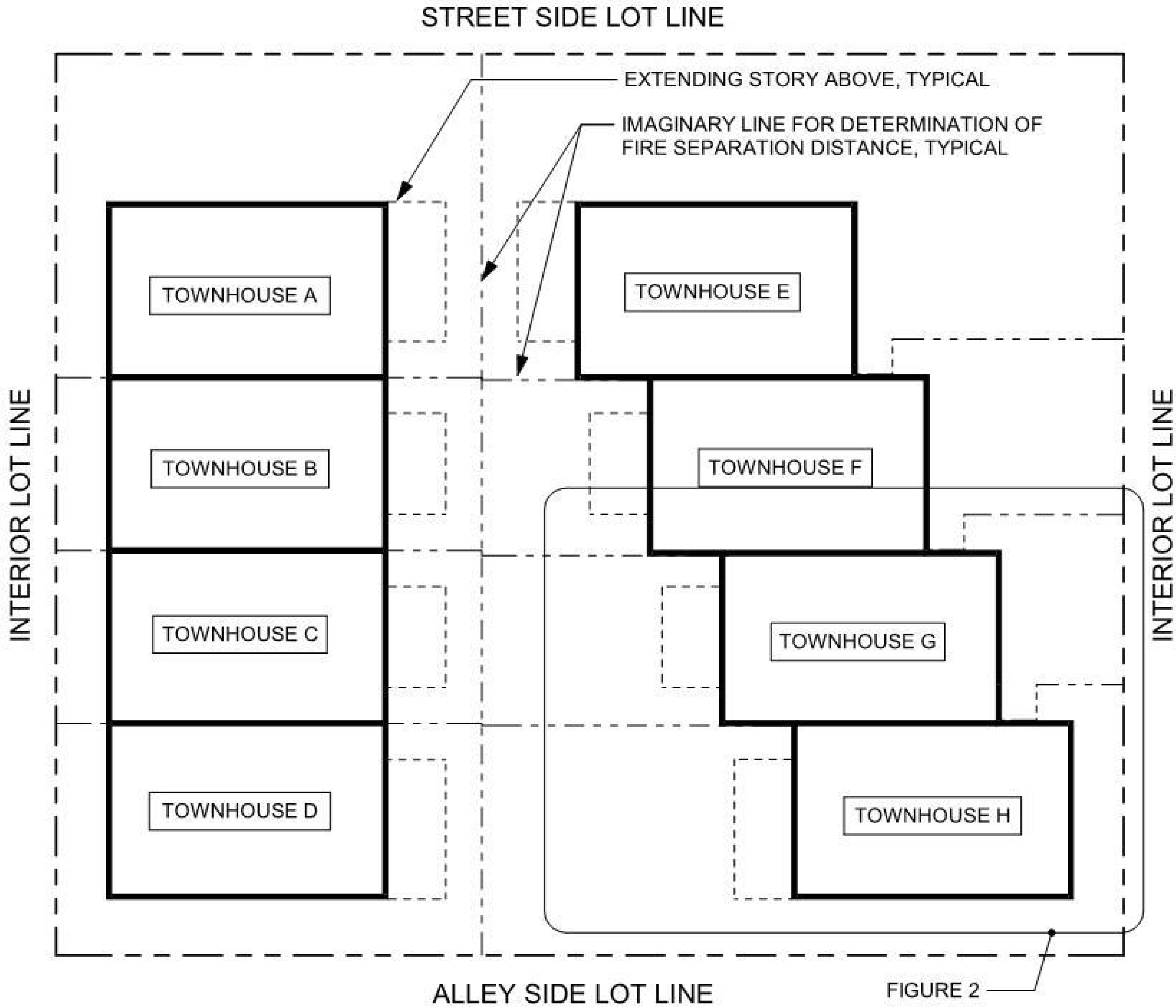
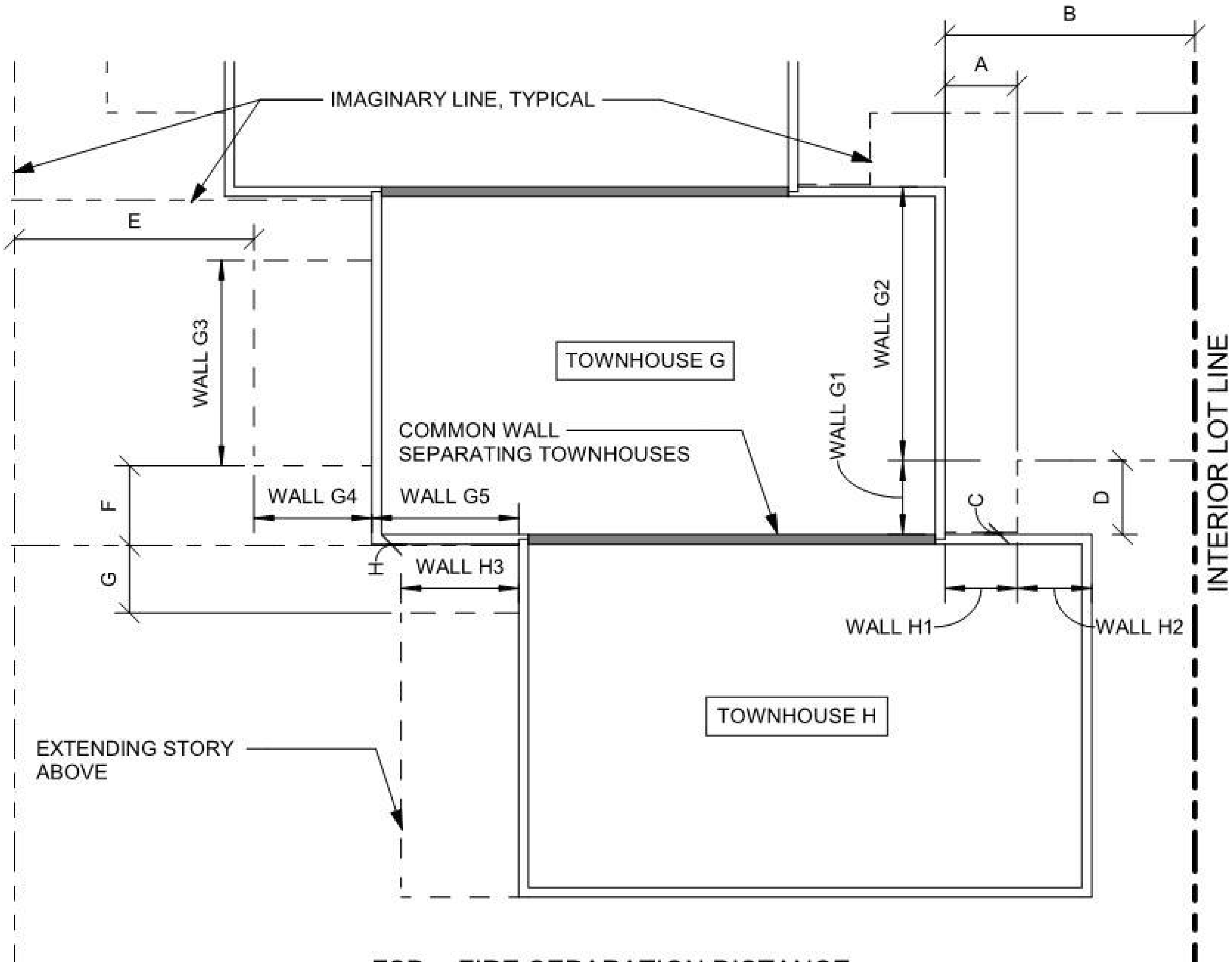


FIGURE 1 - IMAGINARY LINES BETWEEN TOWNHOUSES



FSD = FIRE SEPARATION DISTANCE

A = FSD FOR WALL G1
B = FSD FOR WALL G2
C = FSD = 0 FOR WALL H1
D = FSD FOR WALL H2
E = FSD FOR EXTENDING STORY WALL G3
F = FSD FOR EXTENDING STORY WALL G4
G = FSD FOR EXTENDING STORY WALL H3
H = FSD = 0 FOR WALL G5

FIGURE 2 - EXAMPLE FIRE SEPARATION DISTANCES

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal brings back previous code requirements that I believe are currently being enforced due to the lack of specific townhouse exterior wall requirements in the current code, so there should be no increase or decrease in the cost of construction.

RB53-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal is a problem as there are many other places where it would follow that this term should be inserted, but it is unnecessary. (Vote: 11-0)

Assembly Action: **None**

RB53-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R302.1, [RB] 202, R302.1.1 (New)

Proponents:
David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R302.1 Exterior walls. Construction, projections, openings and penetrations of *exterior walls* of *dwellings, townhouses* and accessory buildings shall comply with Table R302.1(1); or *dwellings* and *townhouses* equipped throughout with an *automatic sprinkler system* installed in accordance with Section P2904 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the *fire separation distance*.
2. Walls of *individual dwelling units* and their *accessory structures* located on the same *lot*.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the *lot*. Projections beyond the *exterior wall* shall not extend over the *lot line*.
4. Detached garages accessory to a *dwelling or townhouse* located within 2 feet (610 mm) of a *lot line* are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior *lot line*.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings or *townhouses* on the *lot*.

The distance shall be measured at a right angle from the face of the wall.

R302.1.1 Townhouses on the same lot. For the purposes of determining *fire separation distance* and the requirements of Section R302.1, *townhouses* on the same *lot* shall have imaginary lines established. Imaginary lines shall begin at the ends of walls separating townhouses required by Section R302.2 and shall extend to a *lot line* or another imaginary line.

Commenter's Reason: The intent of this public comment is to improve on the original proposal by addressing issues raised at the public comment hearings and by emphasizing the need for this code change. This is accomplished as follows:
1. The committee thought the proposal was unnecessary since there will be a lot line between townhouses to measure fire separation distance to, so there would be no need for an imaginary line. First, the IRC does not require a lot line between townhouses nor does it require property lines between townhouses, which are considered to be lot lines by some jurisdictions. A townhouse building can certainly be constructed with one owner and individual townhouses being rented, with no property lines between units. Second, even if there are property lines, some jurisdictions don't consider these to be lot lines and regulate based on the lot designated for development - in Denver this called a zone lot. In this case, property lines (if they exist) are used by the jurisdiction for tax assessment purposes and are often established after the building permit is issued, so they are of no use for building code requirements. In summary, where there is no lot line between townhouses, there is a need to establish an imaginary line to determine fire separation distance and exterior wall requirements. This public comment dictates how these lines are established through a new section R302.1.1 for townhouses on the same lot. If a jurisdiction considers property lines to be lot lines, there are no townhouses on the same lot and this new section does not apply.

2. Opponents had a concern that this proposal brings back the "separate building" concept of a townhouse, but that was/is not the intent and this proposal/public comment in no way creates separate buildings for each townhouse unit - it simply establishes how exterior wall fire-

resistant construction requirements are determined. The original reason statement even stated that townhouses are not separate buildings, so this should not have been an issue. To avoid any interpretation that exterior walls are required where units adjoin (i.e. creating separate buildings), this public comment requires that imaginary lines start at the ends of walls that separate townhouses rather than continuing through the townhouses.

3. The committee thought it was unnecessary to add "townhouses" to this section since "townhouses" could be inserted in many sections of the code where only "dwellings" are mentioned. For example, the means of egress section only mentions "dwellings", but it is obvious that "townhouses" need a means of egress and requirements are the same. The difference here is that there are no code requirements for how to apply exterior wall requirements to townhouses. Do you regulate based on the entire townhouse building or based on each individual townhouse unit? This public comment makes it clear that exterior wall requirements are applied to individual townhouse units, as has been required in the past.

Please support this public comment to bring clarity to the code regarding townhouse exterior wall fire-resistant construction requirements. For cases where lot lines do not exist between townhouses, there is a definite need for this code change since the code is silent on how to apply the exterior wall requirements. For cases where lot lines exist between townhouses, nothing changes from the current code since fire separation distance would be measured to these lot lines.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The cost of construction should not change for reason given in the original proposal.

Public Comment# 1344

RB56-19

IRC®: R302.2.2

Proposed Change as Submitted

Proponents: David Renn, PE, SE, City and County of Denver, representing City and County of Denver (david.renn@denvergov.org)

2018 International Residential Code

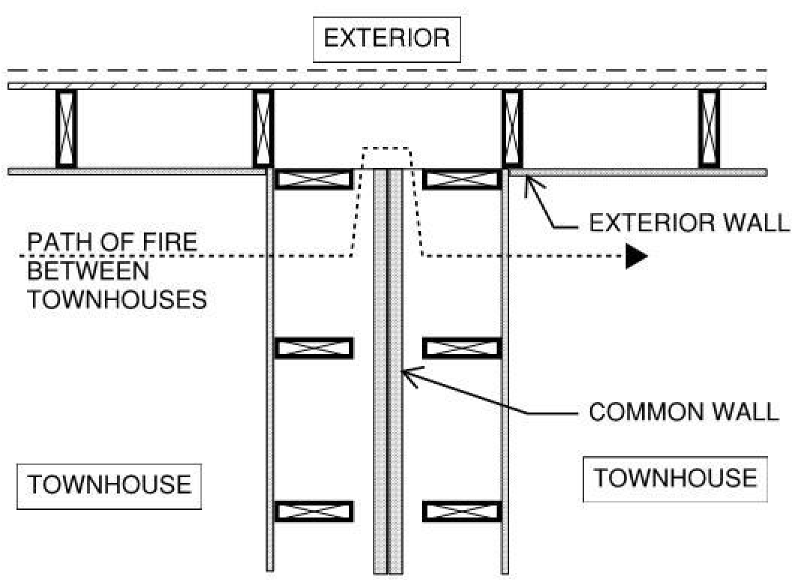
Revise as follows:

R302.2.2 Common walls. Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or ~~2.~~ 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. ~~The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing.~~ Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two two-inch nominal thickness wood studs.

Reason: The code currently allows a townhouse common wall to stop at the interior face of the exterior wall, which can create a path for a fire to spread from one townhouse to the next through the exterior wall. A typical common wall construction is two layers of gypsum board in metal H-studs that are connected to stud walls on either side for stability only, with a gap between the gypsum board and the stud walls. With the gap in this configuration, there is a path a fire can take that is only protected by two layers of 1/2" non-classified gypsum board (or other sheathing) - one on the stud wall adjacent to the common wall on the fire side and one on the same wall of the adjacent townhouse. Two layers of 1/2" gypsum board only provides approximately 30 minutes of fire protection until a fire can spread to the next townhouse. See figure below for clarification of this type of common wall construction.
This proposal requires common walls to continue to the exterior sheathing of the exterior wall, which will eliminate the path of fire described above and will provide the intended fire rating duration of the common wall. For solid exterior walls, such as concrete or masonry, this proposal allows common walls to stop at the inside face since a path for fire to spread from townhouse to townhouse doesn't exist in a solid exterior wall. The exception allows (2) 2x wood studs to be used to extend the common wall through the exterior wall stud cavity. Typical wood studs have a char rate of approximately 1.5" per hour, so this provides the required fire-resistance rating of the common wall.



Cost Impact: The code change proposal will not increase or decrease the cost of construction
The common wall extent requirement in this proposal is the typical way common walls are constructed, so there should be no change in construction or cost of construction.

RB56-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides continuity of common walls that is not provided by current code text. The exception is appropriate. (Vote: 11-0)

Assembly Action: **None**

RB56-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R302.2.2

Proponents:
Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R302.2.2 Common walls. Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

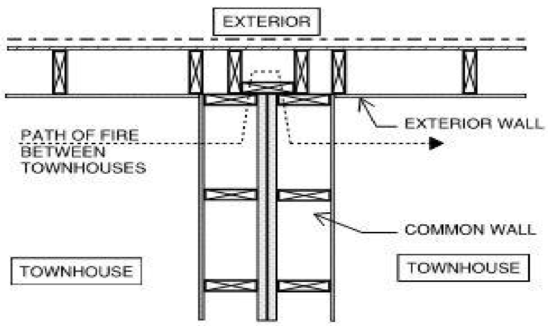
1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

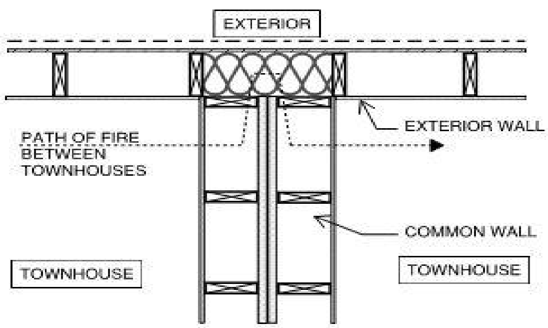
Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls where voids in the exterior wall at the end of the common wall are fireblocked. ~~if the cavity between the end of the common wall and the exterior sheathing is filled with a minimum of two two-inch nominal thickness wood studs.~~

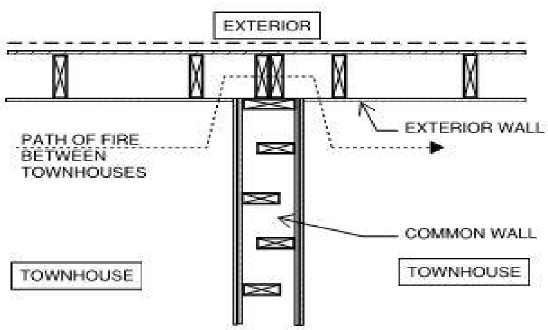
Commenter's Reason: We understand what the proponent was trying to achieve and support the overall proposal, but believe the language in the exception caused an unintended interpretation issue. Additionally we struggling to understand the constructability of the example the proponent provided.
This public comment addresses the interpretation issue of what "filled" actually means in the exception. WABO members indicated it meant the cavity should be completely blocked starting with a minimum of two, two inch wood studs. This cavity could be required to be blocked with 4, 5, or 6, wood studs. We do not believe this was the intent of the proposal and believe the language provided in this public comment provides a greater clarity for these areas.

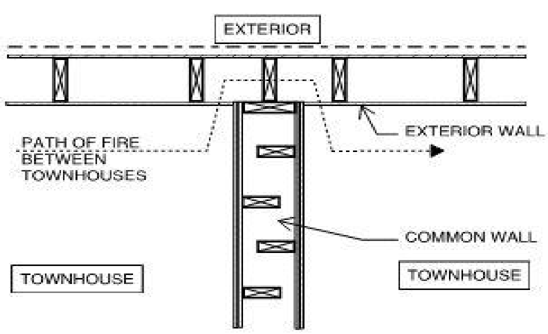
This public comment identifies that the issue the proponent was trying address can be mitigated with fireblocking. Fireblocking is a defined term in the IRC and is what should be identified to use in these areas.

This public comment is only a clarification to the exception language in the approved proposal. Please review the diagrams to see some examples of how this exception can apply.









Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is providing code language to a common construction practice and will not increase the cost of construction.

Public Comment# 1458

RB58-19

IRC®: TABLE R302.1(1), TABLE R302.1(2)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUMFIRE-RESISTANCE RATING	MINIMUM FIRESEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[a, b]	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.
NA = Not Applicable.

a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ~~gable~~ vent openings are not installed in the overhang or in any gable end walls that are common to attic areas.

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUMFIRE-RESISTANCE RATING	MINIMUM FIRESEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c]	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where ~~gable vent openings are not~~ installed <u>in the overhang or in any gable end walls that are common to attic areas.</u>

Reason: Staff continues to get questions regarding these footnotes. The existing language remains unclear, despite recent attempts to fix it. Ray Allshouse, the proponent of the code change that brought this language into the code, was contacted. He indicated that the intent was that if there were no vents at the underside of the overhang, or in any gable end walls (both of which would allow fire to freely move into attic areas), then there should be no requirement to rate the underside of the overhang. Mr. Allshouse also indicated that this concept could be applied gable, hip and any other roof style with overhangs. Where additional attic ventilation is required to make up for the loss of vents at overhangs where fire-separation distance is an issue in accordance these tables and footnotes, additional vents could be added at the underside of eaves in other areas of the dwelling where the fire-separation distance is not an issue, or at roof ridges.
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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on theBCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/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 clarifiction of current code requirements.

RB58-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are improvements that need to be made to make this a complete code change. The proponent requested disapproval. (Vote: 11-0)

Assembly Action: **None**

RB58-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R302.1(1), TABLE R302.1(2)

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUMFIRE-RESISTANCE RATING	MINIMUM FIRESEPARATION DISTANCE
Walls[c]	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[a, b]	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.
NA = Not Applicable.

a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the ~~rake~~ overhang where ~~gable~~ vent openings are not installed and the overhang is protected with fire-retardant-treated-wood, non-combustible material, or gypsum sheathing.

c. Where the fire separation distance for the gable end wall is less than or equal to 3 feet, gable end vents shall not be permitted.

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUMFIRE-RESISTANCE RATING	MINIMUM FIRESEPARATION DISTANCE
Walls[d]	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c]	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.

c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the ~~rake~~ overhang where vent openings are not installed and the overhang is protected with fire-retardant-treated-wood, non combustible material or gypsum sheathing ~~in the overhang or in any gable end walls that are common to attic areas~~.

d. Where the fire separation distance for a gable end wall is less than or equal to 3 feet, gable end vents shall not be permitted.

Commenter's Reason: The original submittal contained several errors. This comment corrects the errors and recognizes that gable end walls are not projections but walls.
The additional language for the FRTW, non-combustible material and gypsum sheathing is to recognize that any material could be used including vinyl or PVC offering little to no protection to the attic space. As 13R and 13D do not require the attic space be sprinkled.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Merely provides another option to user of the code

Public Comment# 1653

Public Comment 2:

IRC®: TABLE R302.1(2)

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MINIMUMFIRE-RESISTANCE RATING	MINIMUM FIRESEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet[a]
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c]	2 feet[a]
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet[a]
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet[a]

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.

b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.

c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where vent openings are not installed in the overhang or in any gable end walls that are common to attic areas.

Commenter's Reason: During the testimony an error was noted in the deleted language in Footnote C. We are correcting that error. Please also see the original proposal reason statement.
This public comment 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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

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 and public comment are a clarifications of current code requirements.

Public Comment# 1248

RB59-19

IRC®: R302.2.3.1 (New)

Proposed Change as Submitted

Proponents: Kirk Nagle, representing Myself (knagle@auroragov.org)

2018 International Residential Code

Add new text as follows:

R302.2.3.1 Occupied Roof Rated Separation. Townhome separation, where the roof is intended to be occupied, shall continue the common wall between units to a height of 8 feet above the walking surface with a minimum one hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the *International Building Code* and shall have noncombustable faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials.

Reason: Occupied roofs are a new building element that has the potiential to cause connected townhomes to be at a significant risk of fire hazard. In reviewing plans and looking at the current code requirements, the potiential for risk of fire conflagration to involve connected townhome units does not seem to be addressed by the 2018 IRC. Fire data from the NFPA related to fires caused by gas grills alone would suggest that not having some protection to connected units leaves the occupants at risk.People will have the gas grills, charcoal grills and other fire related uses to occur on the occupied roofs. Even when fire sprinklers are installed the potiential fire propagation from one unit to another is not addressed. Loss of life or even just losing the use of a home after a fire is significant. This proposal would help increase the chance that the fire would no involve connect units and allow the fire department response to contain the fire on the original unit.
NFPA Report fact sheet U.S. Home Fires Involving Grills

From 2011–2015, U.S. fire departments responded to an average of 9,600 home1 fires involving grills, hibachis, or barbecues per year. That number included an average of 4,100 structure fires and 5,500 outside or unclassified fires. These 9,600 fires caused annual averages of 10 civilian deaths, 160 reported civilian injuries, and $133 million in direct property damage.
ffAlmost all the losses resulted from structure fires.
ffJuly (17%) was the peak month for grill fires, followed by May (14%), June (14%), and August (13%). Three percent of the fires occurred in each of the winter months of December, January, and February.
Causes of Grill Fires

Gas vs. Solid-Fuel Grills
Five out of six (82%) grills involved in home fires were fueled by gas, while 14% used charcoal or other solid fuel.
Gas grills were involved in an average of 7,900 home fires per year, including 3,300 structure fires and 4,700 outdoor fires annually. Leaks or breaks were primarily a problem with gas grills. Twelve percent of gas grill structure fires and 24% of outside gas grill fires were caused by leaks or breaks.
Charcoal or other solid-fuel grills were involved in 1,300 home fires per year, including 600 structure fires and 700 outside fires annually.
Fire and Non-Fire Emergency Room Visits Due to Grills
From 2012–2016, an average of 16,600 patients per year went to emergency rooms because of injuries involving grills.2
Half (8,200 or 49%) of the injuries were thermal burns, including burns both from fire and from contact with hot objects.
About 4,500 of the thermal burns were caused by such contact or other non-fire events.
Children under age 5 accounted for an average of 1,600 or one-third (35%) of the contact-type burns. The burns typically occurred when someone, often a child, bumped into, touched, or fell on the grill, grill part, or hot coals. Keep children away from the grill.

Cost Impact: The code change proposal will increase the cost of construction
The cost of construction will be increased but the ammount is not static because it is based on the varibles of the finishes and type of construction.

RB59-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent said that such problems may occur in the future. We should not look for a problem that does not exist. This is incomplete. There are other types of fire issues on the roof that could be addressed, such as cigarettes, mulch, fire pits, etc. This proposal is moving in the right direction but is not ready for prime time. (Vote: 6-4)

Assembly Action: **None**

RB59-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R302.2.3.1 (New)

Proponents:
Kirk Nagle, representing Myself (knagle@auroragov.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.2.3.1 **Occupied Roof Separation.** Where the roof of a townhouse is built to be occupied, a separation wall not less than 5 feet in height shall be built as a parapet and the wall shall be one hour fire-resistance-rated in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. The parapet wall shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials.

Commenter's Reason: Occupied roofs are a new building element that has the potiential to cause connected townhomes to be at a significant risk of fire hazard. In reviewing plans and looking at the current code requirements, the potiential for risk of fire conflagration to involve connected townhome units does not seem to be addressed by the 2018 IRC. Fire data from the NFPA related to fires caused by gas grills alone would suggest that not having some protection to connected units leaves the occupants at risk.People will have the gas grills, charcoal grills and other fire related uses to occur on the occupied roofs. Even when fire sprinklers are installed the potiential fire propagation from one unit to another is not addressed. Loss of life or even just losing the use of a home after a fire is significant. This proposal would help increase the chance that the fire would no involve connect units and allow the fire department response to contain the fire on the original unit.
This proposal does not only pertain to grills but all of the decorative burning devices and fireworks that occupants of adjoining townhouses will bring up on their occupied roof decks. The committee did not understand that even though I was using data related to grills the problem is very real. Parapets were originally required to reduce the fires impact on adjoining units and now that building designers are building occupied on townhouses it is even more of a threat to life and the building itself.

This is not an if , but a when it happens. Mitigating the damage to adjoining structures and to the very lives of the occupants of the townhouses is why this code change was written. Parapets are required but you can remove them if you follow the code exception, but that exception ignors the reality that the roof would be an occupied space. Even though fire sprinklers are required they would no effect on a roof fire, started on one unit, that would sweep across the whole building, putting lives and property in severe danger.

This code change will save lives please vote in favor of this code change and overturn the committee.

NFPA Report fact sheet U.S. Home Fires Involving Grills

From 2011–2015, U.S. fire departments responded to an average of 9,600 home1 fires involving grills, hibachis, or barbecues per year. That number included an average of 4,100 structure fires and 5,500 outside or unclassified fires. These 9,600 fires caused annual averages of 10 civilian deaths, 160 reported civilian injuries, and $133 million in direct property damage.
ffAlmost all the losses resulted from structure fires.
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Five out of six (82%) grills involved in home fires were fueled by gas, while 14% used charcoal or other solid fuel.
Gas grills were involved in an average of 7,900 home fires per year, including 3,300 structure fires and 4,700 outdoor fires annually. Leaks or breaks were primarily a problem with gas grills. Twelve percent of gas grill structure fires and 24% of outside gas grill fires were caused by leaks or breaks.
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From 2012–2016, an average of 16,600 patients per year went to emergency rooms because of injuries involving grills.2
Half (8,200 or 49%) of the injuries were thermal burns, including burns both from fire and from contact with hot objects.
About 4,500 of the thermal burns were caused by such contact or other non-fire events.
Children under age 5 accounted for an average of 1,600 or one-third (35%) of the contact-type burns. The burns typically occurred when someone, often a child, bumped into, touched, or fell on the grill, grill part, or hot coals. Keep children away from the grill.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of this proposal is significant with design and construction.

Public Comment# 2112

RB60-19

IRC®: R302.2.6

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Residential Code

Revise as follows:

R302.2.6 Structural independence. Each individual *townhouse* shall be structurally independent.

Exceptions:

1. Foundations supporting *exterior walls* or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. *Townhouses* separated by a common wall as provided in Section R302.2.2, Item 1 or 2.
6. *Townhouses* protected by a fire sprinkler system complying with Section P2904 or NFPA 13D.

Reason: The IBC now allows townhouses to be built without structural independence provided that height and area limits for the overall townhouse building are not exceeded. This is true because the firewall requirement to separate units is no longer applicable in such cases. Therefore, only the 1-hour dwelling unit requirement applies, and that assembly is a fire barrier, which has no structural independence requirement. For reference IBC Section 706.1.1, Exception 2 states:
Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.

It makes no sense for the IRC to be more restrictive than the IBC with respect to requiring structural independence when townhouses are sprinklered.

Disclosure: although I am a consultant to the National Fire Sprinkler Association, this proposal is submitted on my own behalf and was not reviewed or endorsed by NFSA prior to submittal.

Cost Impact: The code change proposal will decrease the cost of construction
Construction costs are reduced, consistent with the IBC, based on the allowance to not require structural independence of townhouse units.

RB60-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is a needed clarification to the code that encourages the use of fire sprinkler systems in jurisdictions where fire sprinkler systems are not required. (Vote: 8-3)

Assembly Action: **None**

RB60-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Skalko, representing Masonry Alliance for Codes and Standards (svskalko@svskalko-pe.com)

requests Disapprove

Commenter's Reason: RB60-19 should be disapproved for lack of technical justification. This proposal will exempt townhouses from the requirement for structural independence based on providing sprinkler protection in accordance with Section P2904 or NFPA 13D. While sprinkler protection has been shown to control fires and reduce the impact of fire to the interior of buildings, studies by NFPA have also documented that operating effectiveness of sprinkler protection IS NOT 100%. Reliance on sprinklers operating less than 100% is not equal to in-place physical features of structural independence for the building construction .

Further, the sprinkler protection in P2904 and NFPA 13D will permit sprinkler protection to be omitted from attics and crawl spaces without fuel fire equipment, garages, carports, exterior porches, mud rooms adjacent to exterior doors and similar spaces. Omitting sprinkler protection from these areas while exempting the structural independence results in a reduction in the overall level of fire safety prescribed by the present code requirements.

Finally, the IRC Building Committee reason for approval also does not reflect any technical justification. They state the code change is "a needed clarification to the code that encourages the use of a fire sprinkler system in jurisdictions where fire sprinklers are not required". The code change does not provide any clarification for structural independence of townhouses. It reduces the present level of fire safety in the code through the use of sprinkler protection that is not provided throughout the townhouse.

Recommend RB60-19 be disapproved.

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# 1849

RB66-19

IRC®: R302.3

Proposed Change as Submitted

Proponents: Stephen Thomas, representing Himself (sthomas@coloradocode.net)

2018 International Residential Code

Revise as follows:

R302.3 Two-family dwellings. *Dwelling units* in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code. <u>Such separation shall be provided regardless of whether a lot line exists between the two dwelling units or not.</u> Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the *exterior wall*, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

Exceptions:

1. A fire-resistance rating of $^{1}/_{2}$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.
2. Wall assemblies need not extend through *attic* spaces where the ceiling is protected by not less than $^{5}/_{8}$-inch (15.9 mm) Type X gypsum board, an *attic* draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the *dwellings* and the structural framing supporting the ceiling is protected by not less than $^{1}/_{2}$-inch (12.7 mm) gypsum board or equivalent.

Reason: The intent of this proposal is to clarify the separation between the dwelling units in a two-family dwelling. A proposal (RB52-16) was submitted last cycle that required two 1-hour walls between the units if a lot line existed and a single wall if a lot line was not present. The committee disapproved the change because they felt that the revised language complicated the existing requirements in the code. The proposal intends to simplify the requirements. The presence of a lot line betweent the dwelling units does not change the impact of fire spread from one unit to another. The fire does not know whether there is a lot line there or not. This issue has been raised for many years. That indicates that there is a serious problem with this requirement. The proposal clearly indicates that the one-hour separation is required regardless of the presence of a lot line.
Many people, including the commentary, state that if there is a lot line between the two units, that two 1-hour walls are required. I challenge anyone to show me where in Section 302.3 it states that. This section only requires a single 1-hour wall. There is also no requirement that states that the two units are separate buildings similar to what we used to do with townhouses. So, the application of Section 302.1 is not referenced in this section. The definition of dwelling states that it is any building that contains one or two dwelling units... It is a single building, not two separate buidlings as some would like to say.

Cost Impact: The code change proposal will decrease the cost of construction
Since many jurisdictions are requiring two 1-hour walls when a lot line is present, the cost of the separation will be reduced with this change.

RB66-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The code is silent on this issue and adding this doesn't solve it. It is allowable under the code and this simply forces interpretation. (Vote: 9-1)

Assembly Action: **None**

RB66-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Stephen Thomas, representing Colorado Chapter (sthomas@coloradocode.net)

requests As Submitted

Commenter's Reason: The committee reason actually supports our proposal. The code is silent on the lot line issue. I agree that the code states that the separation is only required to be a one-hour fire-resistant rated assembly. However, there is an ICC committee interpretation and ICC educational materials state that if a lot line is located between the two dwelling units, they are considered two separate buildings and must have two one-hour walls at the separation. Many people agree with this position. We argue that the fire doesn't know whether there is a lot line there or not. The lot line is just used to determine ownership. We submitted a change to say just that last cycle and it was disapproved. This proposal is intended to clarify the issue so different interpretations are eliminated.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
For those areas requiring the the double wall will be able to go to a single wall which will decrease the cost of construction.

Public Comment# 1564

RB67-19

IRC®: R302.4.1

Proposed Change as Submitted

Proponents: Jeffrey Shapiro, P.E., representing Self (jeff.shapiro@intlcodeconsultants.com)

2018 International Residential Code

Revise as follows:

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, or listed fire sprinkler piping, the annular space shall be protected as follows:

1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:
   1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
   1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm^2).
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

Reason: Listed fire sprinkler piping is ignition resistant and will not sustain combustion. Allowing common fire sprinkler piping to protect multiple units in a townhouse can significantly reduce installation costs, and the IBC now allows penetration of townhouse separation walls in any townhouse that does not exceed the height and area limits. For reference IBC SEction 706.1.1, Exception 2 states:
Fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the code official's review and approval, he or she shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.

It makes no sense for the IRC to be more restrictive than the IBC with respect to allowing penetration of sprinkler piping through townhouse separation walls.

Disclosure: although I am a consultant to the National Fire Sprinkler Association, this proposal is submitted on my own behalf and was not reviewed or endorsed by NFSA prior to submittal.

Cost Impact: The code change proposal will decrease the cost of construction
The allowance for sprinkler piping to penetrate townhouse separation walls will reduce the infrastructure required to install a fire sprinkler system in some cases by allowing a shared feed for multiple units.

RB67-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The plastic piping is a concern in a dry system. (Vote: 8-3)

Assembly Action: **None**

RB67-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R302.2.2, R302.4.1, R302.4.2

Proponents:
Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.2.2 Common walls. Common walls separating *townhouses* shall be assigned a fire-resistance rating in accordance with Item 1 or 2. The common wall shared by two *townhouses* shall be constructed without plumbing or mechanical equipment, ducts or vents , other than water-filled fire sprinkler piping, in the cavity of the common wall. The wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Electrical installations shall be in accordance with Chapters 34 through 43. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where a fire sprinkler system in accordance with Section P2904 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.
2. Where a fire sprinkler system in accordance with Section P2904 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.3 of the International Building Code.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exceptions: 1.

1. Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:
   ~~1.~~ 1.1 In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of th
      ~~1.1~~ 1.1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
      ~~1.2~~ 1.1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm^2).

   ~~2.~~ 1.2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where su Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

2. The annular space created by the penetration of water-filled fire sprinkler piping, provided that the annular space is filled using a material cor

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m^2) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet (9.29 m^2) of wall area. The annular space between the wall membrane and the box shall not exceed $^1/_8$ inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:

   1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
   1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
   1.3. By solid fireblocking in accordance with Section R302.11.
   1.4. By protecting both boxes with *listed* putty pads.
   1.5. By other *listed* materials and methods.

2. Membrane penetrations by *listed* electrical boxes of any materials provided that the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the *listing*. The annular space between the wall membrane and the box shall not exceed $^{1}/_{8}$ inch (3.1 mm) unless *listed* otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:

    2.1. By the horizontal distance specified in the *listing* of the electrical boxes.

    2.2. By solid fireblocking in accordance with Section R302.11.

    2.3. By protecting both boxes with *listed* putty pads.

    2.4. By other *listed* materials and methods.

3. The annular space created by the penetration of a fire sprinkler <u>or water-filled fire sprinkler piping, </u>provided that ~~it~~ <u>the annular space </u>is covered by a metal escutcheon plate.
4. Ceiling membrane penetrations by *listed* luminaires or by luminaires protected with *listed* materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the *listing*.

Commenter's Reason: The specific concern expressed by the committee has been addressed by this comment, which limits application of the proposed sprinkler penetration allowance to water-filled pipes. Although plastic pipe has been listed for dry residential sprinkler applications, use of those systems is not common enough to warrant arguing the point and missing this opportunity for progress with wet-pipe systems.
The comment also adds a requirement to follow an already recognized/tested method (in the current exception) for protecting annular spaces surrounding through penetrations. With that increased level of protection, a fire could only pass the membrane by melting the pipe and causing water to leak, which would inherently protect the opening. Flame would be stopped at the barrier.

Additionally, water-filled sprinkler pipes will be allowed in common walls. This option provides for improved sprinkler designs for townhouses by allowing sidewall sprinklers to be deployed from common walls, which unlike exterior walls, are not exposed to freezing exterior conditions. By using sidewall sprinklers to protect the top floor instead of pendent sprinklers in the ceiling, sprinkler piping can be kept out of attics, which are subject to freezing.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposed change provides a design option that builders may or may not choose to use. If the option is selected, it would most likely be based on a decision by the builder that the builder's cost would be reduced.

Public Comment# 1883

RB72-19

IRC®: R302.9, R302.9.2, R302.9.3, R302.9.4, R302.9.1, R302.9 (New), R302.9.1 (New), R302.9.1.1 (New), R302.9.2 (New), R302.9.3 (New), R302.9.4 (New), R302.9.5 (New), R302.9.6 (New), R302.9.7 (New), R302.9.8 (New), R302.9.8.1 (New), R302.9.8.2 (New), R302.9.8.3 (New), R302.9.9 (New), ASTM Chapter 44 (New), NFPA Chapter 44 (New)

Proposed Change as Submitted

Proponents: Marcelo M Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Delete without substitution:

~~**R302.9 Flame spread index and smoke-developed index for wall and ceiling finishes.** Flame spread and smoke-developed indices for wall and ceiling finishes shall be in accordance with Sections R302.9.1 through R302.9.4.~~

~~**R302.9.1 Flame spread index.** Wall and ceiling finishes shall have a flame spread index of not greater than 200.~~

> ~~**Exception:** Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than $^{1}/_{28}$ inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.~~

~~**R302.9.2 Smoke-developed index.** Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.~~

~~**R302.9.3 Testing.** Tests shall be made in accordance with ASTM E84 or UL 723.~~

~~**R302.9.4 Alternative test method.** As an alternative to having a flame spread index of not greater than 200 and a smoke-developed index of not greater than 450 where tested in accordance with ASTM E84 or UL 723, wall and ceiling finishes shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:~~

~~The interior finish shall comply with the following:~~

~~1.During the 40 kW exposure, flames shall not spread to the ceiling.~~
~~2.The flame shall not spread to the outer extremity of the sample on any wall or ceiling.~~
~~3.Flashover, as defined in NFPA 286, shall not occur.~~
~~4.The peak heat release rate throughout the test shall not exceed 800 kW.~~
~~5.The total smoke released throughout the test shall not exceed 1,000 m^2.~~

Add new text as follows:

R302.9 Interior wall and ceiling finishes. Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in accordance with Section R302.9.1 or R302.9.2, unless otherwise shown in Sections R302.9.3 through R302.9.9. Materials tested in accordance with Section R302.9.1 shall not be required to be tested in accordance with Section R302.9.2.

R302.9.1 NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with Section R302.9.1.1. Materials complying with Section R302.9.1.1 shall be considered to also comply with the requirements of Section R302.9.2.

R302.9.1.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m^2.

R302.9.2 ASTM E84 or UL 723. Wall and ceiling finishes shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C) where tested in accordance with ASTM E84 or UL 723, except as shown in Section R302.9.1 and in Sections R302.9.3 through R302.9.9.

R302.9.3 Interior trim. The requirements of Section R302.9.1 and those of Section R302.9.2, for interior wall and ceiling finishes, shall not apply to interior trim, defined as picture molds, chair rails, baseboards and handrails; or to doors and windows or their frames.

R302.9.4 Thickness exemption. The requirements of Section R302.9.1 and those of Section R302.9.2, for interior wall and ceiling finishes, shall not apply to materials having a thickness less than 0.036 inch (0.9 mm) and applied directly to the surface of walls or ceilings.

R302.9.5 High density polyethylene and polypropylene. Where high density polyethylene or polypropylene is used as an interior finish material, it shall be tested in accordance with NFPA 286 and comply with the requirements of Section R302.9.1.1.

R302.9.6 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 R302.9.1.1 where 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 exhibit a Class C flame spread index and smoke-developed index where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

R302.9.7 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 R309.2.1.1 where 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 C flame spread index and smoke-developed index where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.

R302.9.8 Textile or expanded vinyl wall covering materials. Where textile wall covering materials or expanded vinyl wall covering materials are used as interior finish materials they shall be tested for fire performance in accordance with Sections R302.9.8.1, R302.9.8.2 or R302.9.8.3.

R302.9.8.1 Testing of textile or expanded vinyl wall covering materials to NFPA 286. Textile wall covering materials or expanded vinyl wall covering materials shall be tested in the manner intended for use in accordance with NFPA 286 using the product-mounting system, including adhesive, and comply with the requirements of Section R302.9.1.1.

R302.9.8.2 Testing of textile or expanded vinyl wall covering materials to ASTM E84 or UL 723. Textile wall covering materials or expanded vinyl wall covering materials shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C) where tested in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

R302.9.8.3 Testing of textile or expanded vinyl wall covering materials to NFPA 265. Textile wall covering materials and expanded vinyl wall covering materials shall be tested in the manner intended for use in accordance with the Method B protocol of NFPA 265 using the product-mounting system, including adhesive. The wall coverings shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 by 305 mm) walls.
3. Flashover, as defined in NFPA 265, shall not occur.
4. The total smoke released throughout the test shall not exceed 1,000 m^2.

R302.9.9 Textile or expanded vinyl ceiling covering materials. Textile ceiling covering materials or expanded vinyl ceiling covering materials shall be fire tested in accordance with ASTM E84 or UL 723, with the acceptance criteria of Section R302.9.2, or in accordance with NFPA 286, with the acceptance criteria of Section R302.9.1.1. Where tested in accordance with ASTM E84 or UL 723, specimen preparation and mounting shall be in accordance with ASTM E2404.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2404: Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings,Facings and Veneers, to Assess Surface Burning Characteristics (2017)

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2579-15: Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy MA 02169-7471

265: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls (2019)

Reason: This proposal reorganizes the section in the way that it is organized also in the IBC and IFC without changing requirements. Any material can be fire tested to NFPA 286 and those requirements are placed first, in R3029.1. With regard to the base requirement (testing for flame spread index and smoke-developed index by means of ASTM E84 or UL 723, with the corresponding criteria) it is still a Class C (flame spread index of 200 or less and smoke developed index of 450 or less) and it is all in a single section, namely R302.9.2. There is no change in the sense that, just like in the present code, materials can be tested to ASTM E84 or UL 723 (and get a Class C), or they can be tested to NFPA 286, with the requirements

presently in the code.
The following sections address requirements for materials that require special consideration.

Sections R302.9.3 and R302.9.4 address the exceptions: for trim and for very thin materials, adhered directly to the wall or ceiling. The requirement that the very thin material be tested contradicts the point that it is an exception and that it does not need testing. This requirement for testing the very thin material has been eliminated from the IBC and IFC also.

Section R302.9.5 addresses a key fire safety issue: high density polyethylene (HDPE) and polypropylene (PP) materials used as interior finish should not be tested using ASTM E84 because the test results are misleading. Such materials must be tested to NFPA 286, as shown in R302.9.1. This is a fire safety requirement also contained in the IBC and the IFC. The new section addresses the issue that it is not appropriate to allow testing of high density polyethylene (HDPE) and polypropylene (PP) materials used as interior finish in accordance with ASTM E84 or UL 723, because the test results are misleading. Such materials must be tested to NFPA 286, as shown in the new section R302.9.1.

What is needed is some testing requirement for thin materials used as veneers but adhered to wood products, either as manufactured panels brought into the building or as veneers applied on site. They are being addressed in R302.9.6 and R302.9.7.It has been shown that applying veneers over a wood product will have a significant effect (typically negative) on the fire performance of the product. A specific mounting practice for this has been developed both for ASTM E84 (namely ASTM E2404) and a specific section of NFPA 286 was developed for the purpose also. When a veneer is installed on site over a wood substrate, details are needed for fire testing the veneer. It needs to be tested over a substrate that is consistent with the substrate to be used in the application. If the veneer is to be applied over wood it should be tested over wood but if it is to be applied over gypsum board or a noncombustible substrate, it should be tested over that substrate. If the substrate is combustible testing over a wood substrate is an acceptable alternative. Section R302.9.7 addresses the case when manufacturers produce wood panels that have the veneer already applied before being introduced into the building. For that case, a specific mounting practice for ASTM E84 and a specific mounting method for NFPA 286 have been developed. In both cases the requirements involve testing the commercial panel and not the veneer. This language in both sections is consistent with language in the IBC and IRC, except that the requirements are for a Class C in ASTM E84, consistent with the charging paragraph.

Textile wall covering materials and expanded vinyl wall covering materials (Section R302.9.8) are permitted by the IBC and the IFC to be fire tested by three methods (they are the only type of product that have that option). They can be tested to ASTM E84 or UL 723, NFPA 286 and NFPA 265. If they are tested to ASTM E84 or UL 723 they need to use a special mounting method, namely ASTM E2404. Both the IBC and the IFC recognize a specific testing method that applies only to textile wall covering materials and expanded vinyl covering materials, namely NFPA 265. Therefore, commercial materials exist that have been tested to NFPA 265 and there is no reason that they should not be allowed into the IRC without further testing. The proposal contains the criteria from the IBC and IFC for testing to NFPA 265. This proposal does not require the materials to be tested to NFPA 265 or to NFPA 286 but allows materials already tested to NFPA 265 or to NFPA 286 to be used in the IRC. The NFPA 265 test is a room-corner test similar to NFPA 286, except for a few aspects: (a) the burner flame is less severe (150 kW instead of 160 kW), (b) the location of the burner is different (it is not placed flush against the corner) and (c) the material is not placed on the ceiling. Therefore the burner flame never reaches the ceiling, which makes the test unsuitable for ceiling materials.

Textile ceiling covering materials and expanded vinyl ceiling covering materials (Section R302.9.9) are permitted by the IBC and the IFC to be tested to NFPA 286 or to be tested to ASTM E84 or UL 723. However, when they are tested to ASTM E84 they need to use a special mounting method, namely ASTM E2404. They are not permitted to be tested to NFPA 265 because the flame in the test does not reach the ceiling.

Cost Impact: The code change proposal will increase the cost of construction
This proposal provides more testing options for some materials and clarifies the testing requirements that apply to some materials that should not be tested to ASTM E84.

Staff Analysis: The referenced standards, ASTM E 2579, ASTM E 2404 and NFPA 265, are currently referenced in other 2018 I-codes.

RB72-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This action is consistent with previous committee actions on proposals RB73, RB74, RB75 and RB76. This proposal combines those previous proposals and is much too complicated. A much simpler approach should be taken. (Vote: 9-2)

Assembly Action: **None**

RB72-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R302.9 (New), R302.9.1 (New), R302.9.1.1 (New), R302.9.2 (New), R302.9.3 (New), R302.9, R302.9.1, R302.9.2, R302.9.3, R302.9.4

Proponents:
Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R302.9 Interior wall and ceiling finishes. Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in accordance with either Section R302.9.1 or R302.9.2. Materials tested in accordance with Section R302.9.1 shall not be required to be tested in accordance with Section R302.9.2.

R302.9.1 NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with Section R302.9.1.1. Materials complying with Section R302.9.1.1 shall be considered to also comply with the requirements of Section R302.9.2.

R302.9.1.1 Acceptance criteria for NFPA 286. The interior finish material shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m^2.

R302.9.2 ASTM E84 or UL 723. Where wall and ceiling finish materials are tested in accordance with ASTM E84 or UL 723, they shall exhibit a flame spread index not exceeding 200 and a smoke-developed index not exceeding 450 (Class C).

R302.9.3 Exception. The requirements of Sections R302.9.1 and R302.9.2 shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than 1/28 inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.

~~**R302.9 Flame spread index and smoke-developed index for wall and ceiling finishes.** Flame spread and smoke-developed indices for wall and ceiling finishes shall be in accordance with Sections R302.9.1 through R302.9.4.~~

~~**R302.9.1 Flame spread index.** Wall and ceiling finishes shall have a flame spread index of not greater than 200.~~

> ~~**Exception:** Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than 1/28 inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.~~

~~**R302.9.2 Smoke-developed index.** Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.~~

~~**R302.9.3 Testing.** Tests shall be made in accordance with ASTM E84 or UL 723.~~

~~**R302.9.4 Alternative test method.** As an alternative to having a flame spread index of not greater than 200 and a smoke-developed index of not greater than 450 where tested in accordance with ASTM E84 or UL 723, wall and ceiling finishes shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:~~

~~The interior finish shall comply with the following:~~

1. ~~During the 40 kW exposure, flames shall not spread to the ceiling.~~
2. ~~The flame shall not spread to the outer extremity of the sample on any wall or ceiling.~~
3. ~~Flashover, as defined in NFPA 286, shall not occur.~~
4. ~~The peak heat release rate throughout the test shall not exceed 800 kW.~~

5. ~~The total smoke released throughout the test shall not exceed 1,000 m².~~

Commenter's Reason: This public comment replaces the original proposal in its entirety.
This public comment simplifies the original proposal by eliminating all the details of the testing and simply developing two sections: one for testing by NFPA 286 (base requirement) and one for testing by ASTM E84 or UL 723 (Class C). The exception is being retained as a new section clarifying that it applies to testing via NFPA 286 as well as to testing via ASTM E84 or UL 723. The added standards are being eliminated. This is consistent with the comments by the technical committee.

This is consistent with what is in the IBC and in the IFC but the code proposal does not change any of the requirements: it is still simply necessary to have a Class C in ASTM E84 or UL 723 (or be tested to NFPA 286) to be allowed as interior finish but it is clearer that materials that have already been tested to NFPA 286 and have me the corresponding requirements need not be tested again. This makes it explicit that it allows products that have already been tested to NFPA 286 to be used without additional testing.

In summary, this simplifies the code by noting that testing to ASTM E84 (or UL 723) is used for assessing flame spread index and smoke developed index and does it in one section and that NFPA 286 is an acceptable alternate. It also notes that the existing exception applies to both testing to ASTM E84 (or UL 723) and testing to NFPA 286, which is unclear in the code now.

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 as a result of the public comment is editorial cleanup and clarification.

Public Comment# 1517

Public Comment 2:

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests Disapprove

Commenter's Reason: No data has been submitted to support the modification to making a very expensive test the primary test. NFPA is also known as the room corner test. NFPA 286 was added to the code to allow assemblies tested to the standard as meeting the intent of R302.9 and to prevent additional testing if the interior finish material used on the assembly was not also tested using E84. It was never intended to become the primary test.

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

Public Comment# 1664

RB77-19

IRC®: R302.15 (New), R302.15.1 (New), R302.15.2 (New), R302.15.3 (New), R802.1.5, R802.1.5.1, R802.1.5.2, R802.1.5.3, R802.1.5.4, R802.1.5.5, R802.1.5.6, R802.1.5.7

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Add new text as follows:

R302.15 Fire retardant treated wood Fire-retardant treated wood (FRTW) is any wood product that: is impregnated with chemicals by a pressure process or other means during manufacture; that has a listed flame spread index of 25 or less when tested in accordance with ASTM E84 or UL 723, and that does not show evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

R302.15.1 Pressure process For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

R302.15.2 Other means during manufacture For wood products produced 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.

R302.15.3 Testing For wood products produced by means other than a pressure process during manufacture, all sides of the wood product shall be tested in accordance with and produce the results required in Section R302.15. For structural panels, only the front and back faces shall be required to be tested.

Revise as follows:

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) ~~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 and does not show evidence of significant progressive combustion where the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.~~ shall comply with Section R302.15.

Delete without substitution:

~~**R802.1.5.1 Pressure process.** For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).~~

~~**R802.1.5.2 Other means during manufacture.** For wood products produced 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.~~

~~**R802.1.5.3 Testing.** For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. Testing of only the front and back faces of wood structural panels shall be permitted.~~

Revise as follows:

~~**R802.1.5.4**~~ **R802.1.5.1 Labeling.** In addition to the labels required by Section 802.1.1 for sawn lumber and Section 803.2.1 for wood structural panels, each piece of *fire-retardant-treated* lumber and wood structural panel shall be labeled. The label shall contain:

1. The identification *mark* of an *approved agency* in accordance with Section 1703.5 of the International Building Code.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections ~~R802.1.5.5~~ R802.1.5.2 through ~~R802.1.5.10.~~ R802.1.5.7.
8. For FRTW exposed to weather, or a damp or wet location, the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D2898).

~~**R802.1.5.5**~~ **R802.1.5.2 Strength adjustments.** Design values for untreated lumber and wood structural panels as specified in Section R802.1 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.

~~**R802.1.5.6**~~ **R802.1.5.3 Wood structural panels.** The effect of treatment and the method of redrying after treatment, and 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 ASTM D5516 shall be used to develop 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 their treatment.

~~**R802.1.5.7**~~ **R802.1.5.4 Lumber.** For each species of wood treated, the effect of the treatment and the method of redrying after treatment and 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 ASTM D5664 shall be used to develop modification 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 factors for service at 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.

~~**R802.1.5.8**~~ **R802.1.5.5 Exposure to weather.** Where fire-retardant-treated wood is exposed to weather or damp or wet locations, it shall be identified as “Exterior” to indicate there is not an increase in the listed flame spread index as ~~defined~~ required by the testing specified in Section ~~R802.1.5~~ R302.15 when subjected to ASTM D2898.

~~**R802.1.5.9**~~ **R802.1.5.6 Interior applications.** Interior fire-retardant-treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section ~~R802.1.5.6~~ R802.1.5.3 or ~~R802.1.5.7.~~ R802.1.5.4. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

~~**R802.1.5.10**~~ **R802.1.5.7 Moisture content.** Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and ~~plywood~~ the wood structural panels submitted for the tests described in Section ~~R802.1.5.6~~ R802.1.5.3 for ~~plywood~~ wood structural panels and ~~R802.1.5.7~~ R802.1.5.4 for lumber.

Reason: This proposal simply moves fire retardant treated wood (much of which is used indoors or for applications that do not involve roofing) away from the roofing section (jn Chapter 8) and places it in chapter 3 (section 302) where all the products with improved fire performance are. It does not make any change to requirements and uses the same code language but in a more appropriate chapter of the code. A pointer sends the user from the section the information used to be (in chapter 8) to the new location.
Section R302 contains information on all the materials associated with "fire resistant construction", including wall and ceiling finishes, insulation and foam plastics. This is where the information on fire retardant treated wood belongs. Chapter 8 is on roof construction and, as staed above, many uses of fire retardant treated wood are for applications that are not roofs. The proposal keeps in chapter 8 the requirements for the wood products themselves, namely lumber and structural panels, to be consistent with cross-laminated timber and engineered rim wood board and so on. It just moves the requirements specific to fire retardant treated wood.

The changes in this proposal do not alter requirements but just move the sections for logical positioning. The only change in language is in relocated section R802.1.5.10 where the word plywood is replaced by wood structural panel, the title of relocated section R802.1.5.6, which is what is being referred to.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal simply relocates the FRTW sections from the roofing section to a new location, dealing with other fire safety issues, without changing requirements.

RB77-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: In Section R302.15, the terminology is switched. This proposal needs to be reformatted. The strength requirements need to move with the other requirements. We should stick with the original language if there is no intent to change technical requirements. (Vote: 11-0)

Assembly Action: **None**

RB77-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R319, R319.2, R319.3, R319.4, R319.5, R319.6, R319.7, R319.8, R319.9, R319.10, R319.11, R803.2.1.2

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~R802.1.5~~ R319 Fire-retardant-treated wood.

R319.1 Fire-retardant-treated wood (FRTW) 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 and does not show evidence of significant progressive combustion where the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

~~R802.1.5.1~~ R319.2 Pressure process. For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

~~R802.1.5.2~~ R319.3 Other means during manufacture. For wood products produced 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.

~~R802.1.5.3~~ R319.4 Testing. For wood products produced by other means during manufacture, other than a pressure process, all sides of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. Testing of only the front and back faces of wood structural panels shall be permitted.

~~R802.1.5.4~~ R319.5 Labeling. In addition to the labels required by Section 802.1.1 for sawn lumber and Section 803.2.1 for wood structural panels, each piece of *fire-retardant-treated* lumber and wood structural panel shall be labeled. The label shall contain:

1. The identification *mark* of an *approved agency* in accordance with Section 1703.5 of the International Building Code.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections R802.1.5.5 through R802.1.5.10.
8. For FRTW exposed to weather, or a damp or wet location, the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D2898).

~~R802.1.5.5~~ R319.6 Strength adjustments. Design values for untreated lumber and wood structural panels as specified in Section R802.1 shall be adjusted for fire-retardant-treated wood. Adjustments to design values, including fastener 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.

~~R802.1.5.6~~ R319.7 Wood structural panels. The effect of treatment and the method of redrying after treatment, and 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 ASTM D5516 shall be used to develop 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 their treatment.

~~R802.1.5.7~~ R319.8 Lumber. For each species of wood treated, the effect of the treatment and the method of redrying after treatment and 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 ASTM D5664 shall be used to develop modification 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 factors for service at 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.

~~R802.1.5.8~~ R319.9 Exposure to weather. Where fire-retardant-treated wood is exposed to weather or damp or wet locations, it shall be identified as “Exterior” to indicate there is not an increase in the listed flame spread index as defined in Section R802.1.5 when subjected to ASTM D2898.

~~R802.1.5.9~~ R319.10 Interior applications. Interior fire-retardant-treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section R802.1.5.6 or R802.1.5.7. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

~~R802.1.5.10~~ R319.11 Moisture content. Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section R802.1.5.6 for plywood and R802.1.5.7 for lumber.

~~**R803.2.1.2 Fire-retardant-treated plywood.** The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an *approved* method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an *approved agency*.~~

Commenter's Reason: FRTW may be used in more applications than just roofing the placement into R302.15 was deemed incorrect. Also, all of the relevant provisions were not brought over.
This is our attempt to clean up the proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Making the code more user friendly, no technical changes.

Public Comment# 1666

RB78-19

IRC®: R303.3

Proposed Change as Submitted

Proponents: Kevin Gore, Borough of West Chester, representing Borough of West Chester (kgore@west-chester.com)

2018 International Residential Code

Revise as follows:

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with ~~aggregate glazing area in windows of not less than 3 square feet (0.3 m^2), one-half of which shall be openable.~~ ~~**Exception:** The glazed areas shall not be required where~~ artificial light and a local exhaust

~~system are provided.~~
system. The minimum local exhaust rates shall be determined in accordance with Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors.

Reason: Typically, during winter and summer months or when inclement weather occurs, occupants fail to utilize windows in bathroom spaces to provide for proper ventiliation to control moisture and humidity levels. The failure to utilize natural ventilation and the lack of mechanical ventilation in these spaces leads to mold and/or mildew conditions which can ultimately create unsanitary conditions and cause health proplems for the occupants. According to the Centers for Disease Control and Prevention (2017), "In 2004 the Institute of Medicine (IOM) found there was sufficient evidence to link indoor exposure to mold with upper respiratory tract symptoms, cough, and wheeze in otherwise healthy people". Additionally, as we continue to improve the International Energy Conservation Code and enhance the energy efficiency of structures, we defeat the purpose of increased energy efficiency by requiring a window to be open in a space which is being heated or cooled.

Bibliography: Centers for Disease Control and Prevention. 2017. *Facts about mold and dampness.* Retrieved from https://www.cdc.gov/mold/dampness_facts.htm

Cost Impact: The code change proposal will increase the cost of construction
The cost to supply and install a mechanical exhaust fan is approximately $300.00.

RB78-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: A fan is currently required only if a window does not provide the required amount of natural ventilation. Opening a window is a great way to provide ventilation. That option for satisfying the code should not be taken away. Even if a fan is available, that does not mean that occupants will use it. (Vote: 11-0)

Assembly Action: **None**

RB78-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R303.3

Proponents:
Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov); Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with artificial light and a local exhaust system. The minimum local exhaust rates shall be determined in accordance with Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors.

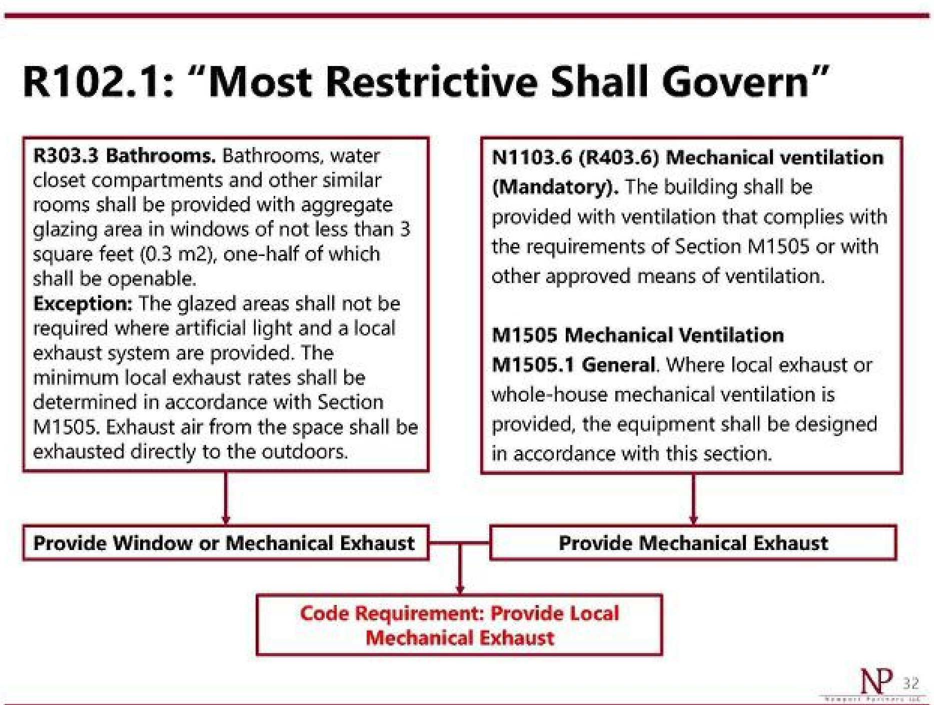
> **Exception:** A local exhaust system shall not be required in spaces exempt from the building thermal envelope provisions of Section N1102 and that are provided with a window having and openable area of not less than 1.5 square feet (0.14 m^2)

Commenter's Reason: Residential bathroom window openings first appeared as a code requirement in the 1946 Uniform Building Code (UBC). Besides window openings in the building perimeter walls, it was common practice for windows to also open into light and ventilation wells or shafts located within the building footprint. This served as a passive means to dissipate moisture, pollutants and odors. The effectiveness of these window openings depended on the atmospheric conditions of seasonal weather.

With the advent of exhaust fans during the fifties, the 1955 UBC added exhaust fans as an alternative means for removing moisture, pollutants and odors in lieu of window openings. Since then, the code language hasn't changed much despite mass adoption of bathroom exhaust fans in new home construction. During the 1980's and 90's, bathroom exhaust fans increasingly became the industry norm for removing moisture, pollutants and odors. Bathroom exhaust fans are no longer the exception but are now the rule, both in practice and by code requirement. Recognizing that tight building envelopes need mechanical ventilation to effectively manage moisture, IRC Section N1103.6 (R403.6) requires mechanical ventilation in accordance with Section M1505, which provides the minimum specifications for mechanical ventilation of bathrooms. For consistency, this code change aligns the requirements in N1103.6 with the language in R303.3 - recognizing that mechanical ventilation is required for any building that complies with the air sealing requirements of Section N1102, aligning the various sections of the code, and reclassifying openable windows as an exception rather than the rule. See the attached flow chart that illustrates how local mechanical exhaust in bathrooms is already required by the IRC.

In regards to natural light, the code change deletes the 3 sq. ft. window glazing (natural light) requirement and requires artificial light for bathrooms. Artificial lighting has been the industry standard since the electrification of homes over the past 80 to 90 years. Regardless of the amount of natural daylight provided, artificial light is still needed for nighttime use. Therefore an exception for artificial light is not needed in lieu of natural light.

This code change will improve the current language for consistency and clarity in the application and enforcement of this section.



History of Bathroom Ventilation Requirements in the UBC (legacy code) and IBC

Complied by Anthony Floyd, City of Scottsdale (7/14/19)

Code Year	Bathroom Window Size	Operable window required	Operable window size	Mech. Exhaust Fan
1927 UBC	Not specified	No	No	Not specified
1935 UBC	Not specified	No	No	Not specified
1937 UBC	Not specified	No	No	Not specified
1940 UBC	Not specified	No	No	Not specified
1943 UBC	Not specified	No	No	Not specified
1946 UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1949-UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1952 UBC	Not less than 3 sq. ft.	Yes	Not specified	Not specified
1955 UBC	Not less than 3 sq. ft.	Yes	Not specified	**Exhaust fan in lieu of operable window**
1958 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1961 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1964 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1967 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1970 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1973 UBC	Not less than 3 sq. ft.	Yes	Not less than one half of required window area shall be openable	Exhaust fan in lieu of operable window
1976 UBC	Not specified.	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1979 UBC	Not specified.	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window

1982 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1985 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1988 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1991 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1994 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
1997 UBC	Not specified	Yes	Min. 1-1/2 sq. ft. exterior opening	Exhaust fan in lieu of operable window
2000 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2003 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2006 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2009 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2012 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2015 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window
2018 IBC	Not less than 3 sq. ft.	Yes	One half of required window area shall be openable	Exhaust fan in lieu of operable window

Bibliography: Residential bathroom ventilation provisions of the following codes:

- Uniform Building Code (UBC) - 1927, 1935, 1937, 1940, 1943, 1946, 1949, 1952, 1955, 1958, 1961, 1964, 1967, 1970, 1973, 1976, 1979, 1982, 1985, 1991, 1994 and 1997 editions
- International Building Code (IBC) - 2000, 2003, 2006, 2009, 2012, 2015, 2018 editions

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 reorders the exception for clarity of existing code requirements. It does not require any additional compliance measures that are not already required in the code.

Public Comment# 1395

RB81-19

IRC®: SECTION R307, R307.1, R307.2, R307.3 (New), R307.3.1 (New), R307.3.2 (New), R307.3.3 (New), R307.3.4. (New), R307.3.5. (New)

Proposed Change as Submitted

Proponents: Jake Pauls, representing self (bldguse@aol.com)

2018 International Residential Code

Revise as follows:

SECTION R307
TOILET, BATH AND SHOWER SPACES, INCLUDING GRAB BAR PROVISION

R307.1 Space required. Fixtures shall be spaced in accordance with Figure R307.1, and in accordance with the requirements of Section P2705.1.

R307.2 Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor.

Add new text as follows:

R307.3 Grab bars. Grab bars shall be in accordance with Sections R303.3.1 trough R303.3.7.

R307.3.1 Grab Bar Provision. New bathtubs and showers shall be provided with grab bars complying with Section R307.3. Positioning of the grab bars, including stanchion type grab bars in addition to conventional wall mounted grab bars, shall be such that they are within reach of bathtub and shower users where such users are standing within the bathtub or shower and standing within the clearance spaces required by R307.2 as illustrated in Figure R307.1.

R307.3.2 Shower grab bar. A vertical grab bar shall be provided with a length of at least 24 inches (610 mm) positioned with its lower end not higher than 39 inches (990 mm) above the finished floor, its upper end not lower than 60 inches (1525 mm) above the finished floor, and located either inside or outside the shower enclosure and usable by a person entering and exiting the shower enclosure to occupy the clear floor area required by R307.2.

R307.3.3 Vertical bar for bathtub. A vertical grab bar with a minimum length of 36 inches (915 mm) shall be provided at the unobstructed entrance for the end wall of the bathtub, adjacent to the clear floor area required by R307.2 and positioned with its lower end not higher than 27 inches (685 mm) above the finished floor and its upper end not less than 60 inches (1525 mm) above the finished floor. If wall-mounted, the grab bar shall be between 9 inches (230 mm) and 12 inches (305 mm), measured horizontally, from the exterior plane of the bathtub. If provided as a stanchion extending from the ceiling to the floor or bathtub rim, the vertical bar shall be not more than 6 inches (150 mm) horizontally of the outer edge of the bathtub and not more than 30 inches (760 mm), measured horizontally, from the control end wall or from the water delivery spout in the absence of a control end wall.

R307.3.4. Horizontal or diagonal grab bar for bathtub. At the non-access side of the bathtub there shall be a diagonal or horizontal grab bar with a length of at least 24 inches (610 mm) placed not higher than 10 inches (255 mm) above the rim of the bathtub. If horizontally oriented the bar shall be positioned not higher than 10 inches above the rim of the bathtub and one end no more than 12 inches (305 mm), measured horizontally, from the control end or the water spout location if there is no control wall end. If diagonally oriented, the higher end shall be not more then 12 inches (305 mm) measured horizontally from the control end wall and between 25 inches and 27 inches (685 mm) above the rim of the bathtub.

R307.3.5. Grab bar details. Grab bars shall be circular in cross section with a minimum diameter of 1.25 inches (30mm) and a maximum diameter of 2 inches (50 mm). There shall be a clearance, for hand grasp, of not less than 1.5 inches (40 mm) between the bar and any surface. Grab bars shall be designed and constructed to withstand a load, in any direction, of 250 pounds minimum. Grab bars shall be designed and constructed with their fixings resistant to corrosion from water and to deterioration, from water, of surfaces and structure to which they are attached.

Reason: Reason Statement for IRC R307, new grab bar requirements in the IRC
General Introduction
Grab bars are what are, more generally, called "points of control" which help us maintain our posture and facilitate movement via our bodily contacts with surfaces underfoot and graspable fixed objects for our hands. For example, stair use requires—for minimum safety—one foot taking our body weight on a step (while the other foot moves between steps) and one hand on a handrail if we need lateral support of our upright bodies and/or some pulling assistance for the stair climb.
Thus, from a code point of view, it is widely accepted that stairs require at least one handrail to assure that at almost all times we have two points of control available when using stairs. The same ergonomic or biomechanical standard has not been generally applied to another dangerous act in buildings, entering and exiting a bathing or showering facility. In a home these facilities will typically require stepping over a bathtub wall or a low dam preventing water from draining onto the floor from a shower pan. This step-over behavior is complicated by the quality of the underfoot surfaces, some wet with water and others insecure due to other conditions (such as a dry towel or mat on a dry but very smooth tile surface) that are precursors to a slip. With this brief, fundamental consideration of the problem and its solution in mind, see Figure 1, a matrix which relates points of

control to simplified regulatory strategies, namely how many points of control are enough.

Right now, for bathing/showering on wet, slippery surfaces the point of control at our feet is very dubious and unreliable. And, currently, home bathrooms very, very seldom have any grab bars. The effective level of points of control in most home bathrooms is less than one. As already noted, stairs even in homes provide about two points of control (although, with undersized tread depths and dysfunctional decorative railings instead of function handrails, that figure of two might be closer to one). See Figure 1 for a hierarchy of points of control and situations where bathtubs/showers exist currently with very substandard availability of points of control combined with dangerous, hard surfaces to fall against and, thus, exacerbate injuries.

Grab Bar Equity with Stair Handrails

Number of Points of Control Via Hands or Feet	≤1	1	2	3	3-4
Standard walker for older adult with altered gait.					✔
Occupational settings with risk of worker falls from heights. Also, stairs where users can use two handrails simultaneously, one on each side.				✔	
Stairs where users have only a single handrail. ***Grab bar(s) usable for bathtub/shower entry/egress.***			✔ ★		
Bathtubs/showers with slip resistant underfoot surfaces when wet.		✔			
Bathtubs/showers without slip resistant underfoot surfaces when wet, the common condition currently.	✔				

Figure 1. Hierarchy of Points of Control
and Proposed Grab Bar Equity with Stair Handrails

Therefore, in recent years, there has been an international move to providing one or more new points of control for bathtubs and showers, largely to aid in two types of transfer for bathtubs—transfers in a standing position over the tub wall (for all tub uses) and transferring from a standing position to sitting or lying and later transferring from a lying or sitting position to standing. These bathtub transfers require two different points of control in relation to where the hand(s) are needed for the two types of transfers. Thus for all bathtub transfers two upper body points of control are needed either sequentially or simultaneously—the latter being increasingly important as one ages and loses lower body strength and has greater issues with balance generally. Especially as we get older, we rely more and more on bilateral support on stairs with handrails on both sides and bathtubs where there are points of control on both sides of the tub if we have a bath as opposed to showering.

The most basic package of grab bar requirements for transfers by ambulatory means is a single vertical grab bar reachable from the entrance area of a bathtub or a dedicated shower. If a bath is desired in a tub, then a diagonally oriented or horizontal bar on the non-access side of the tub is needed where there is often a wall on which to attach a conventional grab bar. An option is to use a horiaontal stanchion (a bar or tube that is attached between surfaces rather than cantilevered from a surface) attached *between* end walls of a tub enclosure. See the installation photograph at the end of this Reason Statement; the horizontal stanchion is held in place by two large tiles through which the stanchion tube is passed with the tube ends butted against the wall tile with no hole made in the wall tile so there is no chance of water entry behind the wall tile due to this installation. High-grade adhesive is used to hold the assembly in place meeting the 250-pound load crtierion easily.

The foregoing was the rationale used to develop the first set of mainstreamed grab bar requirements in a model building code as well as in a companion, safety standard—specifically NFPA 5000 and NFPA 101 in their 2018 editions and retained in the upcoming 2021 editions. The basic set of criteria that were adopted with very little fuss within the NFPA process has now been used to develop a proposal for the IRC, specifically Section R307 which deals with toilet, bath and shower spaces. This was where some people in ICC, during 2018 hearings for Group A code requirements, recommended a new mainstreamed grab bar requirement should be situated. Their advice has been followed in the proposal now submitted for Group B code requirements. (When the proponent started down this road of trying to get grab bar requirements into the I-codes, he was unaware there were various options on where such requirements might best fit. The consensus on this in last year's Group hearings was "*not here*" and, for dwelling units, the logical place to be addressed in Group B was the Planning chapter of the IRC, specifically Section R307 on spaces in bathrooms. Hence, proposed here is the basic, minimum or entry level proposal to mainstreamed grab bars for dwelling units, the most likely context for injuries related to bathtubs and showers.

The Problem of Injuries Associated with Bathtubs and Showers

How Bathtub and Shower-related Injuries Compare to Other Injury Sources. Figure 1 provides a quickly appreciated comparison of the relative size of three problems in buildings: fires, stairs and baths/showers.

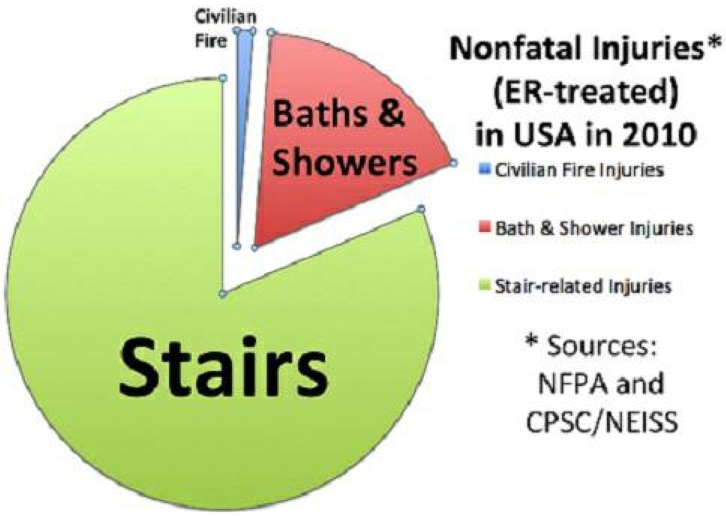


Figure 1. Chart of Approximate Relative Occurrence of Serious Injuries Associated with Three Common Dangers in Homes and Other Buildings

One can quickly see that injuries related to baths/showers greatly outnumber those from fire and that baths/showers are in the same league as stairs in terms of injuries. However, note that when exposure is taken into account, baths/showers are more dangerous. (Exposure will also be addressed in the following section where the other major safety culprit in home bathrooms is briefly noted.)

The central and most important point of this code change proposal is to respond to the relatively high risk of injurious falls when entering and exiting a bathing/showering facility. An organization, PIRE (Pacific Institute for Research and Evaluation), in Maryland is the best available source of some very insightful data collections that have been prepared by likely the finest minds on injury data in the world. PIRE has provided the proponent with data sets that have their origins in the US CPSC National Electronic Injury Surveillance System (NEISS) but have been subjected to intelligent analysis and presentation which are shared here, where they can do a lot of good.

First let us examine data on where (occupancy or building context) bathtub and shower injuries occur in the USA in the years 2010-2014. Table 1(a) provides this data set from PIRE along with a related data set, in 1(b) Table for toilets, the third relatively dangerous facility in home bathrooms.

Bathtubs & showers

	Locale of accident	Frequency	Percent
0	Not recorded	209,935.6	21.02
1	Home	754,831.6	75.57
2	Farm/ranch	25.3	0.00
4	Street/highway	756.9	0.08
5	Other public property	29,838.6	2.99
6	Mobile/manuf home	75.2	0.01
8	School	1,092.9	0.11
9	Place of rec/sports	2,293.3	0.23
	Total	998,849.3	100.00

Toilets

	Locale of accident	Frequency	Percent
0	Not recorded	56,454.2	19.09
1	Home	203,471.0	68.79
4	Street/highway	165.6	0.06
5	Other public property	33,400.8	11.29
8	School	1,541.3	0.52
9	Place of rec/sports	760.4	0.26
	Total	295,793.3	100.00

Tables 1(a) Bathtubs & Showers plus 1(b) Toilets: Injuries by Locale in the US

Some important preliminary lessons from these tables: first homes are, by far, the most common locale for bathroom-related injuries. People can avoid using showers anywhere, but they need to use toilets everywhere.

Next, let us examine data on rates of injuries by age group and the context of professional treatment for those injuries. Again we compare two tables addressing (a) bathing/showering and (b) toileting.

Bathtubs & showers			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	92.0	107.1	3.3	1.1	204.0
10-19	84.6	54.7	1.3	0.5	141.1
20-29	159.5	81.7	3.1	1.1	245.4
30-39	272.7	90.4	3.7	1.1	368.9
40-49	301.5	88.6	5.5	1.7	397.2
50-59	285.8	87.6	8.8	3.1	385.3
60-69	222.1	77.4	15.6	5.2	320.3
70-79	284.3	105.9	33.3	10.4	433.8
>=80	429.0	201.0	90.4	24.7	745.1
Total	215.2	89.6	10.3	3.2	318.3

Toilets			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	20.2	19.2	0.6	0.2	40.1
10-19	7.1	6.0	0.3	0.1	13.4
20-29	17.5	12.2	0.6	0.3	30.6
30-39	37.7	14.7	1.2	0.3	53.9
40-49	46.0	16.3	2.6	1.0	65.8
50-59	61.7	21.6	5.1	1.6	90.0
60-69	93.3	32.6	12.8	4.4	143.1
70-79	154.7	59.7	32.8	10.4	257.6
>=80	375.0	179.8	112.0	30.1	696.9
Total	57.6	25.3	8.7	2.6	94.2

Tables 2(a) Bathtubs & Showers plus 2(b) Toilets:
Injury Rates by Age & Treatment Context

Some important preliminary lessons from these tables: First, note the heightened vulnerability of older adults to injuries—at rates ten to a hundred times higher than for younger and middle-age adults. Second, note for the very oldest people, toilets are especially dangerous because their use—or avoidance of use—is not by choice as is the case for showers and baths. Third, note for the oldest people, injuries tend to be very serious as the rate for minor treatment is close to the rate for hospital admission.

Next, let us examine data on incidence (estimated number) of injuries by age group and the context of professional treatment for those injuries. Again we compare two tables addressing (a) bathing/showering and (b) toileting.

Bathtubs & showers			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	37,209.4	43,339.8	1,331.7	666.4	82,547.3
10-19	35,633.2	23,065.4	550.0	193.0	59,441.6
20-29	69,977.6	35,853.2	1,362.6	482.8	107,676.2
30-39	111,103.0	36,699.4	1,497.8	444.1	149,744.3
40-49	128,478.0	37,743.3	2,339.7	706.7	169,267.6
50-59	122,562.0	37,817.5	3,806.7	1,332.2	165,518.4
60-69	70,334.1	24,507.2	4,954.2	1,648.5	101,444.0
70-79	50,248.3	18,727.5	5,880.1	1,832.0	76,687.9
>=80	49,813.7	23,342.6	10,501.9	2,864.2	86,522.4
Total	675,359.0	281,096.0	32,224.6	10,169.9	998,849.5

Toilets			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	8,162.7	7,752.4	235.8	90.6	16,241.5
10-19	2,997.7	2,507.3	109.4	31.9	5,646.3
20-29	7,660.3	5,348.3	275.1	139.9	13,423.6
30-39	15,285.7	5,965.9	481.2	132.8	21,865.5
40-49	19,586.3	6,929.6	1,121.8	414.5	28,052.1
50-59	26,660.4	9,330.3	2,190.4	707.6	38,888.7
60-69	29,557.7	10,315.4	4,054.4	1,383.1	45,310.7
70-79	27,339.4	10,463.1	5,791.4	1,838.0	45,431.9
>=80	43,548.8	20,879.0	13,006.3	3,498.9	80,933.0
Total	180,799.0	79,491.3	27,265.8	8,237.2	295,793.3

Tables 3(a) Bathtubs & Showers plus 3(b) Toilets:
Injury Incidence by Age & Treatment Context

Some important preliminary lessons from these tables: Note that there are many injuries occurring to younger people so their greater preference for frequent bathing/showering is not reduced by the dangers; they still fall due to factors that go beyond frailty and/or balance issues that increase with older people. Their injuries might be less severe but they are still highly vulnerable to incidents with balance or footing, for example, from which they are less likely to be hurt very badly. In other words, there are problems to be addressed across the life span with bathing/showering.

The societal cost of these injuries was (for 2010) about 20 billion dollars for US bathtubs plus showers and about 93 billion dollars for US stairs with the greatest risk for both being in homes, where bathing/showering is a near daily activity for most people in the US (Data source: Lawrence, B., Spicer, R., Miller, T. A fresh look at the costs of non-fatal consumer product injuries. *Injury Prevention,* digital publication, August 2014, paper journal publication, 2015:**21**:23-29.)

Source of the Text of the Proposed New Requirements for IRC Section R307.3

The source of the proposed new requirements is a few sources, first the proponent's proposals of last year for Group A changes to the IBC (first Means of Egress, Ch. 10 and later Interior Environment, Ch. 12) and the IRC (plumbing). A Comment was submitted only for the IBC knowing already that there were numerous suggestions that the best place in the IRC was not for a section in Group A; it was the Planning Chapter in Group B.

Other sources include activity in Canada on two separately submitted proposals, from 2007 and 2015, for mainstreamed grab bars, first only in homes and later in all occupancy contexts.

The best source was the proposals that have actually been incorporated in a major set of documents, NFPA 5000 and NFPA 101. The latter, in addition to adopting a package of requirements for mainstreamed grab bars in virtually every non-healthcare occupancy, adopted a new scoping provision (1.1.6): "Injuries from Falls. The Code also addresses reducing injury to occupants from falls." (NFPA 5000 already had such an expanded scope from its inception.) The proponent for both the successful mainstreamed grab requirements and the new scope statement was the current proponent of the two proposals to the I-Codes in Group A in 2018 and is the proponent of this proposal in Group B during 2019.

To be specific, for a few reasons the proponent elected to pattern the now-proposed requirements, for an expansion of IRC R307.3, on what NFPA has adopted and will soon include in its next code editions, the 2021 editions of NFPA 5000 and NFPA 101. This is not done out of loyalty to NFPA but, more fundamentally, because with all the discussions that have been going on internationally over the last two decades on improved bathroom safety, there is a consensus emerging on what a package of mainstreamed grab bar proposals should contain. So, bottom line, the ICC has a widely considered proposal in Group B for the IRC during 2019. They have had much discussion and, as noted in last year's proposals, the proponent is a devoted documenter of bathrooms in hotels in many countries due to, first, his attention to detail and, second, the need to document bathroom facilities to near-forensic standards for his 130 nights of travel using a variety of hotels, wth rooms in a wide range of price categories, each year. Finally, the proponent practices what he preaches; see Figure 2 for the bathroom in his dwelling unit; it would readily comply with the proposed IRC requirements.

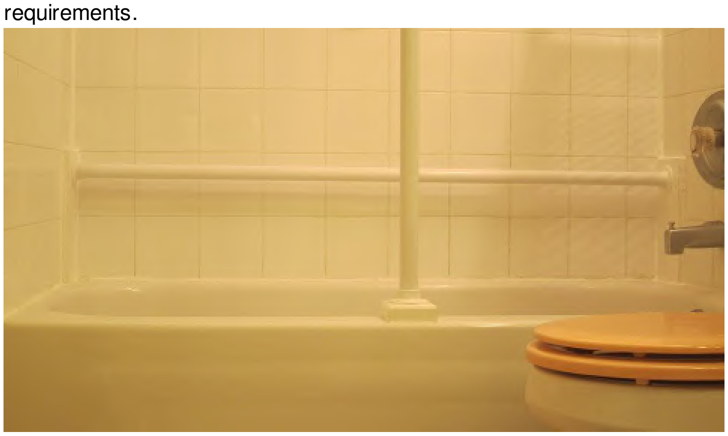


Figure 2. Bathroom Retrofitted (in a rental apartment) with Mainstreamed Grab Bar Set That Would Comply with the Proposed IRC Requirements for R307.3

Bibliography: An extensive bibliography of about 50 items was provided with all the Group A proposals on grab bars. That can be obtained from cdpAccess archives as well as from the proponent. There was only one citation to the ltierature in this Group B proposal and all the usual bibliographic information was included in the Reason Statement text.

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

From careful analysis on related code change proposals in Canada (where an Impact Analysis is being required for many proposed changes to the National Building Code of Canada. The bottom line is that the payback period for the few hundred dollars of materials and labour to install two grab bars per shower-bathtub combination in a dwelling, even for two bathrooms in such a dwelling, is on the order of several years. After that, the grab bars just keep preventing and mitigating falls for decades, given the large cost of bathing/showering-related injuries as discussed in the Reason Statement.

RB81-19

Public Hearing Results

Errata: This proposal includes published errata

Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: These requirements should be optional. The dimensions are not sufficient for all medical conditions. It might be more palatable if only the blocking had to be installed. (Vote: 11-0)

Assembly Action: **None**

RB81-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R307.3 (New), R307.3.1 (New), R307.3.2 (New), R307.3.3 (New), R307.3.4. (New), R307.3.5. (New)

Proponents:
Jake Pauls, representing self (bldguse@aol.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R307.3 Grab bars. Grab bars shall be in accordance with Sections R30~~3~~ 7.3.1 through R30~~3~~ 7.3.7.

R307.3.1 Grab Bar Provision. New bathtubs and showers shall be provided with grab bars complying with Section R307.3. Positioning of the grab bars, including stanchion type grab bars in addition to conventional wall mounted grab bars, shall be such that they are within reach of bathtub and shower users where such users are standing within the bathtub or shower and standing within the clearance spaces required by R307.2 as illustrated in Figure R307.1.

R307.3.2 Shower grab bar. A vertical grab bar shall be provided with a length of at least ~~24~~ 36 inches (~~610~~ 915 mm) positioned with its lower end not higher than ~~39~~ 24 inches (~~990~~ 610 mm) above the finished floor, its upper end not lower than 60 inches (1525 mm) above the finished floor, and located either inside or outside the shower enclosure and usable by a person entering and exiting the shower enclosure to occupy the clear floor area required by R307.2.

R307.3.3 Vertical bar for bathtub. A vertical grab bar with a minimum length of 36 inches (915 mm) shall be provided at the unobstructed entrance for the end wall of the bathtub, adjacent to the clear floor area required by R307.2 and positioned with its lower end not higher than 27 inches (685 mm) above the finished floor and its upper end not less than 60 inches (1525 mm) above the finished floor. If wall-mounted, the grab bar shall be between 9 inches (230 mm) and 12 inches (305 mm), measured horizontally, from the exterior plane of the bathtub. If provided as a stanchion extending from the ceiling to the floor or bathtub rim, the vertical bar shall be not more than 6 inches (150 mm) horizontally of the outer edge of the bathtub and not more than 30 inches (760 mm), measured horizontally, from the control end wall or from the water delivery spout in the absence of a control end wall.

R307.3.4. Horizontal or diagonal grab bar for bathtub. At the non-access side of the bathtub there shall be a diagonal or horizontal grab bar with a length of at least 24 inches (610 mm) placed not higher than 10 inches (255 mm) above the rim of the bathtub. If horizontally oriented the bar shall be positioned not higher than 10 inches above the rim of the bathtub and one end no more than 12 inches (305 mm), measured horizontally, from the control end or the water spout location if there is no control wall end. If diagonally oriented, the higher end shall be not more then 12 inches (305 mm) measured horizontally from the control end wall and between 25 inches and 27 inches (685 mm) above the rim of the bathtub.

R307.3.5. Grab bar details. Grab bars shall be circular in cross section with a minimum diameter of 1.25 inches (30mm) and a maximum diameter of 2 inches (50 mm). There shall be a clearance, for hand grasp, of not less than 1.5 inches (40 mm) between the bar and any surface. Grab bars shall be designed and constructed to withstand a load, in any direction, of 250 pounds minimum. Grab bars shall be designed and constructed with their fixings resistant to corrosion from water and to deterioration, from water, of surfaces and structure to which they are attached.

Commenter's Reason: There has been an immense effort within Canada to develop a new generally applicable requirement for grab bars for all new bathtubs and showers in all occupancy settings. That proposed change to the National Building Code of Canada is going out for public review this autumn for incorporation in the NBCC 2020 edition. Over the last decade there has been a dedicated task group working on this change based on the weight of public health evidence, cost-benefit analysis, and careful consideration of how such a change fits in with international requirements (including NFPA 101 and NFPA 5000 requirements in their 2018 editions and continued incorporation in these codes' 2021 editions) and input from internationally active researchers on the subject of bathing safety for all ages.
The proposed NBCC provisions were originally based on NFPA requirements which also took account of ICC/ANSI A117.1 requirements for people

with disabilities so as to avoid incompatibilities among codes with mainstreamed requirements and standards specific to people with disabilities. This large international effort, based on the best available evidence, leads to some very minor tweaking of RB81-19.

Aside from correcting a few typos in R307.3, the technical change, in R307.3.1 and R307.3.3, is to the minimum vertical grab length, from 24 inches to 36 inches, and positioning of the lower end of the grab bar at a maximum height of 24 inches above the finished floor. This brings the ICC proposal into close alignment with the proposed 2020 Canadian requirements. Notably, bathtub and shower facilities in new Canadian homes are very similar to those in new US homes.

Turning to the ICC IRC-B Committee reasons for disapproving RB81-19, there are only three reasons given and two are completely unresponsive to the published evidence on the need for points of control for bathing and showering for which the risks of injury—*per unit of exposure (about once per day in the US)*—greatly exceeds that for stair-related injuries. Notably, all codes, including the IRC, require stairs to have handrails, the points of control that parallel those provided by grab bars and stanchions for bathtubs and showers. All ages are impacted by bathing/showering-related injuries, with the largest number being to young to middle-age adults. Thus the suggestion of the IRC-B Committee that grab bar "requirements should to optional" completely misses the point. Indeed, if the Committee were responsible for brakes on motor vehicles (or even bicycles), they would not have any brakes. Such vehicles never are sold to the consumers with the mere provision of incomplete braking systems, waiting for consumers to recognize that the installation is incomplete and a difficult and expensive retrofit is needed to make the vehicles fit for use in all conditions by all drivers.

The second of the three reasons given by the Committee, about "medical conditions" makes not sense whatsoever.Thus the disapproval decision by the IRC-B Committee should be overturned by ICC membership.

If ICC membership insists on maintaining the disapproval of RB81-19, it should be conditional on a move ICC leadership and ICC Chapters should pursue as quickly as possible. That is setting up a special study group/process for examining the epidemiological, economic, ergonomic and (generally) public health aspects—i*n addition to construction feasibility*— of both bathtub/shower and stairway-related injuries which are currently leading to over five million professional treatments annually in the US. That is over four million such injuries for stairways and over one million injuries for bathtubs/showers. The societal cost of such injuries is well over one-hundred billion dollars per year in the US.

Reductions in such injury tolls, at least in new homes, are on the order of 60 percent for both stairways and bathtubs/showers. (See similar recommendations for a study group/process for stair-related proposals RB112-19 and RB118-19.)

If ICC continues to bungle along with very inferior requirements for the most dangerous aspects of homes—*their bathtubs/showers and their stairways*—it stands to lose immense credibility with the public. Both issues have been addressed in formally adopted policy positions of the American Public Health Association—*specifically in relation to improvements in NFPA and ICC codes and standards*—but only NFPA meets such APHA criteria for evidence-based usability and safety requirements. ICC has to move beyond its failure to utilize the available scientific and public health evidence for these two top-ranked injury sites in homes and other buildings. That will mean stopping ICC's reliance on uninformed, personal and organizational input to its code-development process as witnessed in the public hearings on these matters generally, and on the three proposals (identified above) in Albuquerque.

Bathtubs & showers			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	92.0	107.1	3.3	1.8	204.0
10-19	84.6	54.7	1.3	0.5	141.1
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40-49	301.5	88.6	5.5	1.7	397.2
50-59	285.8	87.6	8.8	3.1	385.1
60-69	222.1	77.4	15.6	5.2	320.3
70-79	284.3	105.9	33.3	10.4	433.8
>=80	429.0	201.0	90.4	24.7	745.1
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00-09	20.2	19.2	0.6	0.2	40.1
10-19	7.1	6.0	0.2	0.1	13.4
20-29	17.5	12.2	0.6	0.3	30.6
30-39	37.7	14.7	1.2	0.3	53.9
40-49	46.0	16.3	2.6	1.0	65.8
50-59	61.7	21.6	5.1	1.6	90.0
60-69	93.3	32.6	11.8	4.6	141.2
70-79	154.7	59.7	32.8	10.4	257.0
>=80	375.0	179.8	112.0	30.1	696.9
Total	57.6	25.3	8.7	2.6	94.3

Tables 2(a) Bathtubs & Showers plus 2(b) Toilets:

Injury Rates by Age & Treatment Context

Bathtubs & showers			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	37,209.4	43,339.8	1,331.7	666.4	82,547.3
10-19	35,633.2	23,065.4	550.0	193.0	59,441.6
20-29	69,977.6	35,853.2	1,362.6	482.8	107,676.2
30-39	111,103.0	36,699.4	1,497.8	444.1	149,744.3
40-49	128,478.0	37,743.3	2,339.7	706.7	169,267.6
50-59	122,562.0	37,817.5	3,806.7	1,332.2	165,518.4
60-69	70,334.1	24,507.2	4,954.2	1,648.5	101,444.0
70-79	50,248.3	18,727.5	5,880.1	1,832.0	76,687.9
>=80	49,813.7	23,342.6	10,501.9	2,864.2	86,522.4
Total	675,359.0	281,096.0	32,224.6	10,169.9	998,849.5

Toilets			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	8,162.7	7,752.4	235.8	90.6	16,241.5
10-19	2,997.7	2,507.3	109.4	31.9	5,646.3
20-29	7,660.3	5,348.3	275.1	139.9	13,423.6
30-39	15,285.7	5,965.9	481.2	132.8	21,865.5
40-49	19,586.3	6,929.6	1,121.8	414.5	28,052.1
50-59	26,660.4	9,330.3	2,190.4	707.6	38,888.7
60-69	29,557.7	10,315.4	4,054.4	1,383.1	45,310.7
70-79	27,339.4	10,463.1	5,791.4	1,838.0	45,431.9
>=80	43,548.8	20,879.0	13,006.3	3,498.9	80,933.0
Total	180,799.0	79,491.3	27,265.8	8,237.2	295,793.3

Tables 3(a) Bathtubs & Showers plus 3(b) Toilets:

Injury Incidence by Age & Treatment Context

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
While there is some added original construction cost associated with provision of the proposed fall-related injury prevention and mitigation measures, the costs are more than balanced with savings in injury-related costs within one to ten years of use and the proposed new measures have useful service lives measured in several or more decades.

Public Comment# 2087

RB88-19

IRC®: R310.1

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Storm shelters and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m^2).
2. Where the *dwelling* or *townhouse* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
2.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.
2.2. Two means of egress complying with Section R311.
3. A *yard* shall not be required to open directly into a public way where an infill property is located next to adjoining neighboring properties without rescue openings that do not open directly into a public way.

Reason: The purpose of this code change is to address the condition where infill lots, and single lot new residential construction (i.e. townhomes/rowhouses), do not have the capacity for rescue openings to open directly into a public way. An infill project may not have the ability to comply with the rescue opening requirements by having access to a public way because the front yard may be non-existent, utility lines, steps and other constraints prevent placing an area well in the sidewalk, the side yards are non-existent due to party walls, and the rear yard may already be delineated without access to a public way due to the neighboring conditions, existing historic design of the neighborhood, or landlocked properties. This occurs in particular where fenced-in yards already exist for the neighboring properties.
The problem is that since an infill project is considered new construction, compliance with zoning laws and ordinances, and for some projects historic design criteria, has led to denials of building permits. The code provisions have created a conflict between trying to maintain the architectural character of the neighborhood and meeting what the building code requires for new construction.

If a rear yard is required to open to a public way, and is next to adjoining existing neighboring properties with yards not opening to a public way, the code will affect the viability of the new infill project and where bedrooms can be located within the residence. With no public access in the rear yard or side yards, due to party walls or existing fences, all bedrooms will have to be located at the front of residence as that may be the only unobstructed path to a public way since sleeping areas require an emergency escape rescue opening. Basements may have to be left unfinished or used only for storage and utilities. This potentially reduces the market value of the new infill property relative to its neighbors since the adjoining properties do not have to follow the EERO requirements for new construction.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change will not increase or decrease the cost of construction since the new infill construction design intent is to match the neighboring existing properties also without rescue openings not opening directly into a public way.

RB88-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The concept is good, but it needs language clarifications. The purpose should not be to eliminate EEROs, but to allow an escape path for a new dwelling on an infill property. "Adjoining" and "neighboring" is redundant. This appears to be a way to circumvent code requirements just because one has neighbors. That should not be allowed. Life safety requirements should not be compromised just because it is difficult. Properties do not have rescue openings, buildings do. (Vote: 11-0)

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IRC®: R310.1

Proponents:
Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R310.1 Emergency escape and rescue opening required. *Basements, habitable attics* and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where *basements* contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Storm shelters and *basements* used only to house mechanical *equipment* not exceeding a total floor area of 200 square feet (18.58 m^2).
2. Where the *dwelling* or *townhouse* is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:

   2.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.

   2.2. Two means of egress complying with Section R311.

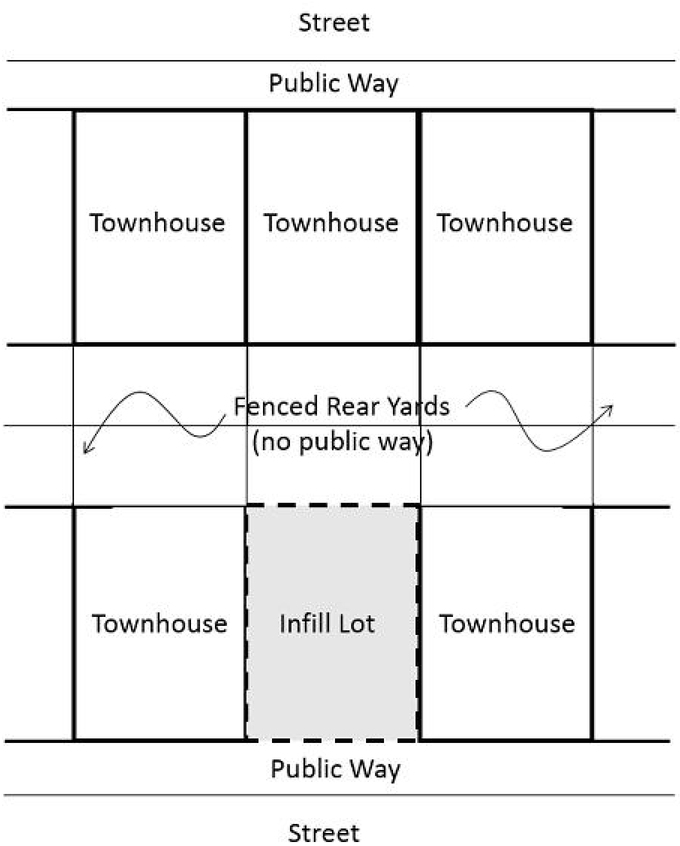
3. An *emergency escape and rescue opening* shall not be required to open directly into a *public way* or to a *yard* or *court* that opens to a *public way* where the building is located between existing buildings with *yards* or *courts* that do not open directly into a *public way*.

Commenter's Reason: The purpose of this code change is to address the condition where infill lots, and single lot new residential construction (i.e. townhomes/rowhouses), do not have the capacity for emergency escape rescue openings (EERO's) to open directly into a public way, as currently required. Affecting a small percentage of infill properties primarily located in older and historic neighborhoods, an infill project may not have the ability to comply with the EERO requirements by having access to a public way because the front yard may be non-existent and because utility lines, steps, and other constraints prevent placing an area well in the sidewalk.
Side yards are non-existent due to party walls, and the rear yard may already be delineated without access to a public way due to the neighboring conditions, existing historic design of the neighborhood, or landlocked properties. This occurs where fenced-in yards already exist for the neighboring properties, as detailed in the included graphic.

If a rear yard is required to open to a public way, and is next to adjoining existing neighboring properties with yards not opening to a public way, the code will affect the viability of the new infill project and where bedrooms can be located within the residence, because of EERO requirements. With no public access in the rear yard or side yards, due to party walls or existing fences, all bedrooms will have to be located at the front of residence as that may be the only unobstructed path to a public way since sleeping areas require an EERO.

Basements may have to be left unfinished or used only for storage and utilities. This potentially reduces the market value of the new infill property relative to its neighbors since the adjoining properties do not have to follow the EERO requirements for new construction.

The problem is that since an infill project is considered new construction, compliance with zoning ordinances, and for some projects, historic design criteria, has led to denials of building permits. The code provisions have created a conflict between trying to maintain the exterior historic architectural character of the neighborhood and meeting what the building code requires for new construction and EERO requirements.



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 will not increase or decrease the cost of construction since the design intent is to address the emergency escape and rescue opening issues with new construction.

Public Comment# 1707

RB89-19

IRC: R301.1 (New), R310.1

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

SECTION R310
EMERGENCY ESCAPE AND RESCUE OPENINGS

Add new text as follows:

R310.1 General. Emergency escape and rescue openings shall comply with the requirements of this section.

Revise as follows:

~~R310.1~~ R310.2 ~~Emergency escape and rescue opening~~ Where required. Basements, habitable attics and every sleeping room shall have ~~not less~~ not fewer than one ~~operable~~ emergency escape and rescue ~~opening. Where *basements* contain~~ opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room , but shall not be required in adjoining areas of the basement. ~~Emergency escape and rescue~~ Such openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior egress balcony that opens to a public way.
~~1.~~ 3.~~Storm shelters and*basements*~~ Basements used only to house mechanical equipment and not exceeding a total floor area of 200 square feet (18.58 m^2) shall not be required to have emergency escape and rescue openings.
4. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
~~2.~~ 5. Where the dwelling or townhouse is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
~~2.1.~~ 5.1One means of egress complying with Section R311 and one emergency escape and rescue opening.
~~2.2.~~ 5.2Two means of egress complying with Section R311.

Reason: The intent of this proposal is to coordinate with the approved changes to INC (E107-18 AMPC1) and clarify the exceptions.
Adding Section R310.1 is to coordinate with the format modification made by the public comment to E107-18.

There are revisions to the exceptions for where emergency escape and rescue openings are required. Exceptions 1 and 2 are current exceptions for EEROs in the IBC. New exception 1 is for basements with ceiling so low that they would not typically include normally occupied spaces. New exception 2 is to allow for the option of a door. The current exception 1 has been divided into new exceptions 3 and 4. New exception 3 clarifies that the 200 sq.ft. limit was for basements that only house mechanical equipment. The new exception 4 separates out storm shelters and adds a specific reference for ICC 500 (currently referenced in ICC R323). The current exception 2 is renumbered only.

This is one of a series of proposal to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a coordination item for exceptions for EEROs already permitted between the codes.

RB89-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The exterior egress balcony is not coordinated with the IRC. There should be a requirement that the exterior egress balcony be at least 36 inches wide. There should be a public comment to address Exception 2. Consider substituting "habitable" for "80 inches." (Vote: 7-4)

Assembly Action: **None**

RB89-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R310.2 (New)

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R310.2 Where required. Basements, habitable attics and every sleeping room shall have not fewer than one emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way, or to a *yard* or court that opens to a public way.

Exceptions:

1. Basements ~~with a ceiling height of less than 80 inches (2032 mm)~~ that do not contain habitable spaceshall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard~~,~~ or court ~~or exterior egress balcony~~ that opens to a public way.

   3. Basements used only to house mechanical equipment and not exceeding a total floor area of 200 square feet (18.58 m^2) shall not be required to have emergency escape and rescue openings.
4. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Where the dwelling or townhouse is equipped with an automatic sprinkler system installed in accordance with Section P2904, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:

   5.1 One means of egress complying with Section R311 and one emergency escape and rescue opening.

   5.2 Two means of egress complying with Section R311.

Commenter's Reason: The modifications in this public comment are to address the committee reasons for disapproval.
Exception 1 –Section 305.2 set habitable areas in basements at 80" minimum ceiling height. So the exception as stated would be coordinated with 'habitable' and ceiling height.

Exception 2 – Exterior egress balconies are in the IBC, but not the IRC. Without criteria, this option will be deleted. This is a commercial multi-family option, not a single family option.

This public comment 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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a coordination item for exceptions for EEROs already permitted between the codes.

Public Comment# 1251

RB90-19

IRC®: R310.1.1

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

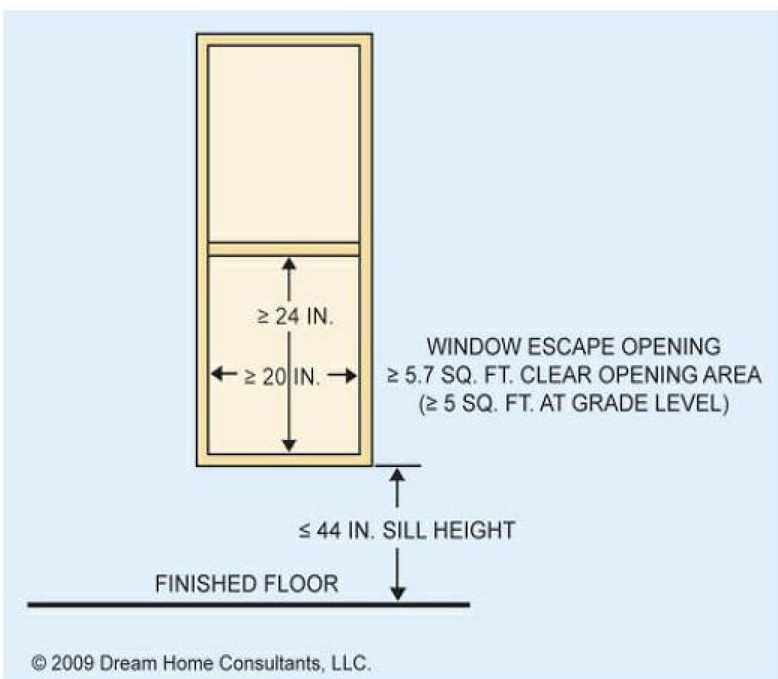
2018 International Residential Code

Revise as follows:

R310.1.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices on windows serving as a required emergency escape and rescue opening shall <u>be not more than 70" (177.8 cm) above the finished floor and shall </u>comply with ASTM F2090.

Reason: The 70” (177.8 cm) is the sum of the dimensions in the attached example of a single hung egress window having a maximum 44” sill height with a 24” operable leaf. Added to this is 2” to reach the latch to unlock the window which is set at 70". Similarly on a casement window, the lock should also be no higher than 70” (177.8 cm) .
Unlike the dimensions for clear area, sill height, and minimum openings, a height has never been determined for the location of window contols for emergency and escape openings. This would make it very clear for all users of the code.

The 70” (177.8 cm) is the sum of the dimensions in the attached example of a single hung egress window having a maximum 44” sill height with a 24” operable leaf. Added to this is 2” to reach the latch to unlock the window which is set at 70". Similarly on a casement window, the lock should also be no higher than 70” (177.8 cm) .



Cost Impact: The code change proposal will not increase or decrease the cost of construction
This merely indicates the height of where the control should be. It would not add any cost to to the manufacturing and installation.

RB90-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The proponent made a good case for the addition of the dimensions and the limitation of the operation and control dimension height. (Vote: 9-2)

Assembly Action: **None**

RB90-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests Disapprove

Commenter's Reason: Initially, while we do not believe such a requirement is necessary, we did not oppose it at the Committee Action Hearings. However, after further consideration we are seeking disapproval for that reason. In particular, because it establishes a requirement for the maximum height of window opening control devices (WOCD’s) when they are required, but provides no direction for where on the device the measurement is to be taken. Typically, WOCD’s vary in height from approximately 1.5” – 2.0.” While in most common cases this may not be an issue because the entire WOCD is clearly located below 70,” it will be problematic when any portion of the WOCD is at 70.” In those cases, where is the measurement to be taken? At the top of the device, middle of the device, bottom of the device, some other location? If a maximum height requirement for required WOCD’s is thought to be necessary, more clarity is needed for how it is to be applied. Given that clarity is not provided by this proposal and the need for the requirement is somewhat questionable, we are seeking disapproval.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This will decrease the cost of construction by alleviating an ambiguity as to where measurements for WOCD's are to be taken which could result in installed windows being needlessly rejected, or costly modifications to the installation that could also result.

Public Comment# 1820

RB93-19

IRC: R310.1.1

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

~~R310.1.1~~ R310.2.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or , tools ~~or special knowledge~~. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening ~~shall comply with ASTM F2090~~.

Reason: The term "special knowledge" was removed from IBC because the phrase “special knowledge’ is too open for interpretations.

The revision to the last sentence could not require opening control devices or fall prevention devices. This section would just allow for them to be on windows that were also serving as emergency escape and rescue openings. ASTM F2090, *Specification for Window Fall Prevention Devices with Emergency Escape (Egress Release Mechanisms),* includes criteria for window fall prevention devices and window opening control devices (see Section R312.2). This standard is specifically written for window openings within 75 feet (22 860 mm) of grade and specifically allows for windows to be used for emergency escape and rescue. This standard was updated in 2008 to address window opening control devices. This control device can be released from the inside to allow the window to be fully opened in order to comply with the emergency escape provisions in IRC.

This is one of a series of proposal to coordinate the requirements for emergency escape and rescue openings in the IBC and IRC. While independent issues, if all the proposals are approved, the IRC section would appear as indicated in the reason for the proposal to revise the definition – emergency escape and rescue openings.

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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a coordination item for emergency escape and rescue openings.

RB93-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This clarifies when it is appropriate to use these types of constraint devices on EEROs. (Vote: 10-1)

Assembly Action: **None**

RB93-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R310.2.1 (New)

Proponents:
Stephen Thomas, representing Colorado Chapter (sthomas@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R310.2.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys ~~or~~ , tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening .

Commenter's Reason: This proposal reinserts the language "special knowledge" back into the section. The proponent's reason statement stated, "The term "special knowledge" was removed from IBC because the phrase “special knowledge’ is too
open for interpretations". We disagree with this reason. This language has been used in many locations of the IBC and the IRC with no problem of interpretation. Code Officials are smart enough to understand the intent of this language. By removing this language, you open up the possibility of manufacturer's stating that their windows are in compliance with the code if you just remove the window sash. This doesn't require the use of any tool or key. You just have to find the little release mechanisms and pull the window sash out. Many single and double hung windows would meet this condition. This was proposed many years ago and rejected. These types of windows should not be permitted to be used as emergency and escape and rescue openings. They do not provide a quick and easy way of opening windows.
The proponents reason also noted that this requirement was removed from the IBC. We feel that this was a mistake as well, but did not catch the change in the last cycle. The IRC is a separate and distinct code from the IBC. They do not need to be the same. The requirement for emergency escape and rescue openings are very limited in the IBC. They are required in all buildings in the IRC. There is more chances of a homeowner making revisions to an opening that would require special knowledge to open the window.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Since this would put the language back into the code as originally existed, there would be no change in the costs.

Public Comment# 1324

RB96-19

IRC®: R310.2.2

Proposed Change as Submitted

Proponents: Timothy Pate, Colorado Chapter Code Change Committee, representing City and County of Broomfield (tpate@broomfield.org)

2018 International Residential Code

Revise as follows:

R310.2.2 Window ~~sill~~ opening height. Where a window is provided as the emergency escape and rescue opening, ~~it shall have a sill height of~~ the bottom of the clear opening shall be not more than 44 inches (1118 mm) above the floor; where the ~~sill height~~ bottom of the clear opening is below *grade*, it shall be provided with a window well in accordance with Section R310.2.3.

Reason: This proposal is to change the existing language back to what was changed in 2012. It was changed to the current language in 2015 (and stayed the same in 2018) with no apparent reason since it was a part of a larger change. This same language was changed for the 2012 (RB41-09/10) to measure to bottom of opening since it is confusing to what a sill is (no definition) and sills can be much lower than the bottom of opening especially with the heights of the window tracks on a lot of current vinyl windows. I am proposing to change this language back to what was in the 2012. This would also match the current language in IBC section 1030.3.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase or decrease the cost of construction. It will only clarify what the intent of the code is.

RB96-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal based on prior action on RB94 and per the proponent's request. (Vote: 11-0)

Assembly Action: **None**

RB96-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Timothy Pate, representing Colorado Chapter Code Change Committee (tpate@broomfield.org)

requests As Submitted

Commenter's Reason: This public comment is to overturn the committee from a disapproval to approved as submitted in case RB94-19 which was approved is overturned and disapproved by membership. RB94-19 did the same as what my code change did but also did other good changes. If RB94 is not challenged I will withdraw this public comment.

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

Public Comment# 1263

RB102-19

IRC®: R310.6

Proposed Change as Submitted

Proponents: Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (Jeffrey.Hinderliter@dos.ny.gov); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R310.6 Alterations or repairs of existing basements. An emergency escape and rescue opening is not required where existing *basements* undergo alterations or repairs.

> **Exception:** New ~~sleeping rooms~~ <u>habitable spaces</u> created in an existing *basement* shall be provided with emergency escape and rescue openings in accordance with Section R310.1.

Reason: This exception emphasizes the importance of providing an emergency escape and rescue opening (EERO) when sleeping rooms are added to existing basements. However, when a basement is altered to create habitable space, such as a living room or recreational room, many of the same risks will be encountered in an emergency. In addition, when a basement is reconfigured to create multiple rooms, those rooms may not remain for non-sleeping purposes. For example, if a basement office is later converted to a bedroom, owners will rarely seek a permit.
The intention of this code change is to increase the safety of basements when they are converted to habitable space and not just sleeping rooms. This code change would cause an owner to install an EERO when the alteration of a basement causes a basement to become habitable, which would include spaces used for living, sleeping, eating or cooking.

Cost Impact: The code change proposal will increase the cost of construction
This code change could increase the cost of construction due to EEROs being installed in habitable spaces rather than just sleeping rooms. If a basement was undergoing an alteration to create a habitable space other than a sleeping room, an EERO would now be required.

RB102-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The building codes should not address the "what if" scenarios. If the basement is finished later, then the EERO must be installed. If put in initially, the opening may be in the wrong location when the basement is finished. (Vote: 8-3)

Assembly Action: **None**

RB102-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Felix Zemel, representing ICC Region 6 -- North East Regional Coalition (felix@pracademicsolutions.com); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Submitted

Commenter's Reason: The Committee's published reason for disapproval is *"The building codes should not address the "what if" scenarios. If the basement is finished later, then the EERO must be installed. If put in initially, the opening may be in the wrong location when the basement is finished. (Vote: 8-3)"*

To address the committee's first comment on being a "what-if", this proposal is not addressing a “what if” scenario and EERO’s are currently required in all new basements, whether they are habitable or not. The commentary to this section of code states in part “…the requirement for basements and habitable attics exists because they are so often used as sleeping rooms…”

As acknowledged by the IRC commentary, basements are frequently used as an extension of living space. This proposal simply requires those spaces converted to habitable spaces to provide the same level of egress as new construction.

To address the committee's second comment on EEROs being placed in the wrong location, this proposal does not tell you where it is to be placed. In creating the habitable space, the applicant will have the choice of where to best place the EERO to meet the code requirements. This is a similar situation to placing an EERO in a new basement that does not have habitable space.

Based on the original reason statement, the dissenting committee member's comments, and the information above addressing the committee's comments, the inclusion of EERO's in basements that are undergoing an alteration to create habitable space is a logical and consistent change to the IRC.

Bibliography: *2018 IRC Code and Commentary—Volume 1*. First Printing, Vol. 1 of 2, International Code Council, 2018.
2018 International Residential Code. First Printing, International Code Council, 2017.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated previously, this code change could increase the cost of construction due to EEROs being installed in habitable spaces rather than just sleeping rooms. If a basement was undergoing an alteration to create a habitable space other than a sleeping room, an EERO would now be required.

Public Comment# 1524

RB107-19

IRC®: [RB] 202, R311.7, R311.8

Proposed Change as Submitted

Proponents: Shaunna Mozingo, City of Westminster, representing Self (smozingo@cityofwestminster.us)

2018 International Residential Code

Revise as follows:

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another ~~within or attached to a building, porch or deck.~~

R311.7 Stairways. Where provided or required by this code, stairways shall comply with this section.

Exception: stairways not within or attached to a building, porch or deck

R311.8 Ramps. Where provided or required by this code, ramps shall comply with this section.

Exception: Ramps not within or attached to a building, porch or deck

Reason: Does a stair from a deck have to comply with any code requirements? That depends on who you talk to.
R311 talks about residential means of egress and requires one means of egress from a dwelling unit. With stairsway provisions included under MOE in 311, does that mean that only stairs for the requiired egress have to comply and all others do not? 1/3 of those questioned believe this.

The definition of a stairway was changed to include some scoping to show that it includes levels attached to or within the building or porch or deck. Since the definition includes that wording, 1/3 of the people polled believe that all stairs that attach to the building or are within the building must comply.

R311.4 Vertical egress specifically mentions vertical egress being required from habitable spaces and doesnt mention decks and porches so the last third believe that the requirement is only for stairs of habitable spaces that must comply.

This proposal takes the scoping language out of the IRC definition so that the definition now matches the IBC definition and has added the scoping into the stairway and ramp sections so that the intent of the definition is actually realized in code language.

In CDP Access, R311.7 and8 are putin as sections instead of subsections so it wouldnt let us edit as you can a subsection so we hope you get the idea that the intent is to read as follows:

R311.7 Stairways. When provided or required by this code, stairways shall comply with this section.

Exception: stairways not within or attached to a building, porch or deck

All remaining subsections of 311.7 unchanged. the same would work for ramps under r311.8.

We would also ask that the word "stairway" be italicized throughout R311 to clear up some of this. we were initially going to just suggest this as the fix but many agreed that the scoping wording in the IRC definition needed to come out and be placed in the body of the code.

Cost Impact: The code change proposal will increase the cost of construction
Some people will say it increases cost because stairs that were not from habitable space never had to comply. some will say that it will not increase cost because all stairs within or attached to the building had to always comply.

RB107-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R311.7 Stairways. Where ~~provided or~~ required by this code or provided, stairways shall comply with this section.

Exception: stairways not within or serving ~~attached to~~ a building, porch or deck

R311.8 Ramps. Where ~~provided or~~ required by this code or provided, ramps shall comply with this section.

Exception: Ramps not within or serving ~~attached to~~ a building, porch or deck

Committee Reason: This proposal clarifies the use of the code. The modification changes "serving" to "attached to," which is more appropriate. (Vote: 6-5)

Assembly Action: **None**

RB107-19

Individual Consideration Agenda

Public Comment 1:

IRC®: [RB] 202, R311.7

Proponents:
Timothy Pate, representing City and County of Broomfield (tpate@broomfield.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another

R311.7 Stairways. Where required by this code or provided, stairways shall comply with this section.

~~Exception~~ Exceptions:

1. Stairways not within or serving a building, porch or deck.
2. Stairways leading to non-habitable attics

Commenter's Reason: This public comment is to clarify that you would not need to have stairways to non habitable attics have to meet the main stairway requirements since you could actually have a fixed ladder of a pull down stair which do not meet any stair requirements and the area is classified as non habitable for living purposes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is just a clarification of existing code requirements

Public Comment# 1977

Public Comment 2:

IRC®: [RB] 202, R311.7

Proponents:
Timothy Pate, representing City and County of Broomfield (tpate@broomfield.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another

R311.7 Stairways. Where required by this code or provided, stairways shall comply with this section.

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

1. Stairways not within or serving a building, porch or deck.
2. Stairways that lead to crawl spaces.

Commenter's Reason: This proposal is to add additional language to clarify that if you have a stairway to a crawl space it would not need to meet the stairway code requirements since you can also have ladders which do not meet any code requirements. Crawl spaces are not habitable spaces.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal is to clarify intent of existing code language

Public Comment# 1984

RB109-19

IRC®: R311.4

Proposed Change as Submitted

Proponents: Mike Fischer, Kellen Company, representing Self (mfischer@kellencompany.com)

2018 International Residential Code

R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* that are not provided with an egress door in accordance with Section R311.2 shall be by a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7. Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Reason: The IRC Contains some Means of Egress requirements, but does not address some constructions that fall outside of exit and egress. The code requires stairways to comply with a series of requirements for landings, stair tread and rise, handrailes, headroom etc. Attics that are not habitable spaces and are thus unoccupiable should be exempt from stairway requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is consistent with current practice.

RB109-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal needs work. Having unregulated stairs is an issue. It would be preferred that some types of alternatives be proposed. Lesser requirements may be appropriate, but some level of safety should be specified. (Vote: 6-5)

Assembly Action: **None**

RB109-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R311.4

Proponents:
Mike Fischer, representing Self (mfischer@kellencompany.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R311.4 Vertical egress. Egress from habitable levels including habitable attics and *basements* that are not provided with an egress door in accordance with Section R311.2 shall be served by a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7. Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Commenter's Reason: This proposal is intended to be a clarification of the current IRC requirements for stairways. The proposal is modified by this public comment to insert a missing word "served" in R311.4; that is outside of the original proposal but is offered for the good of the order.
I submitted this proposal because my brother built a detached garage in Chittenango NY, and wanted to utilize the space above the truss rafters for storage. I reviewed the code with the local code official, who approved the installation of stairs that allow access to the attic storage space but that do not meet the rise and run requirements for stairways serving means of egress in R311.7. In researching the issue, I discovered a gap in the code for these types of features that are not part of a means of egress.

Back to the proposal- which adds the following sentence: Why is this only a clarification and not a change?

Stairways serving attics that do not contain habitable space are not required to meet the requirements of Section R311.7.

Section R311 is titled MEANS OF EGRESS. That title is not defined in the IRC, but is found in the IBC. The IRC defaults to other codes for missing definitions:

R201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have the meanings ascribed in other code publications of the International Code Council.

The IBC definition of MEANS OF EGRESS:

[BE] MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a *public way*. A means of egress consists of three separate and distinct parts: the *exit access*, the *exit* and the *exit discharge*.

Additional Definitions for your consideration:

[RB] DWELLING. Any building that contains one or two *dwelling units* used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes

[RB] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered *habitable spaces*.

[BG] OCCUPIABLE SPACE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with *means of egress* and light and *ventilation* facilities meeting the requirements of this code.

Section R311 by definition can only apply to Means of Egress, and only from occupied portions of dwellings. While the IBC definition of Means of Egress is applied to buildings other than dwellings, the IRC limits MOE to serve occupied portions of dwellings. Note that the term “occupied” is not defined in the IRC, but “Occupiable Space” is defined in the IBC (see above.)

The IRC Means of Egress requirements are clear- IF you follow the trail of bread crumbs through the definitions. Here is the charging language:

R311.1 Means of egress. *Dwellings* shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the *dwelling* to the required egress door without requiring travel through a garage.

Note that Section R311.1 prohibits travel through a garage as part of the means of egress.

The proposal is specifically focusing on attics without habitable space. A finished attic in a garage cannot utilize a stairway through the garage as part of a means of egress per R311.7. The IRC stairway requirements only apply to means of egress; there is no required means of egress from non-habitable spaces- because of the IBC definition.

Some would say that homeowners will change an unfinished attic into habitable space in the future. If that occurs, it would be a violation of the code. The code should not be preempting the intent of future building occupants and assuming the worst-case scenario.
If we believe that stairs leading to non-habitable space should meet the means of egress requirements “just in case”, then the code should require those same attic spaces to have windows to provide natural light and ventilation, an emergency escape and rescue opening (just in case the homeowner decides to add a sleeping room), AND an exterior landing and stairway to provide a code-compliant means of egress.

Please approve as modified by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposal will clean up an enforcement issue that often results in erroneous application of stairway requirements.

Public Comment# 2170

RB112-19

IRC®: R311.7.5.1, R311.7.5.2, R311.7.5.2.1

Proposed Change as Submitted

Proponents: Jake Pauls, representing self (bldguse@aol.com)

2018 International Residential Code

Revise as follows:

R311.7.5.1 Risers. The riser height shall be not more than 7 ~~3/4~~ inches ~~(196~~ (180 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open risers, openings located more than 30 inches (762 mm), as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on spiral stairways.
2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than ~~10 inches (254~~ 11inches (280 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $^3/_8$ inch (9.5 mm).

R311.7.5.2.1 Winder treads. Winder treads shall have a tread depth of not less than ~~10~~ 11 inches ~~(254~~ (280 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than $^3/_8$ inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within $^3/_8$ inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth at spiral stairways shall be in accordance with Section R311.7.10.1.

Reason: This proposal shares the Reason Statement for Proposal 5467, which includes the changes proposed on the step rise and tread depth — changing 7.75 inches for the maximum rise to 7 inches and changing the minimum tread depth from 10 inches to 11 inches in Sections R311.7.5.1, R311.7.5.2 and R311.7.5.2.1. Proposal 5467 accomplishes the same change indirectly by deleting almost all the requirements of R311.7 and requiring that stairs comply with NFPA 101-2018 which has the "7-11" requirement applying to dwelling unit stairs (with an exception for certain spiral stairs for which more options are provided in NFPA 101 than in the IRC). Those interested in this proposal should refer to the Reason Statement for Proposal 5467 dealing with all of R311.7. The bottom line is that if the "7-11" rule is applied (as it has for two decades for all other stairs in the IBC) and the dangers of injuries on stairways are mostly in homes, that is where the "7-11" should also be required. The Reason Statement provides very extensive technical and other information that directly confirms the much better performance of the "7-11" geometry relative to the several times more dangerous step dimensions — including the 7.75 - 10 geometry — that have been used in homes where about 90 percent of the stair-related falls occur in the US at a huge cost to everybody — currently on the order of $100 billion dollars annually in societal injury costs in the USA.

Bibliography: A few publication are cited in the Reason Statement for my Proposal # 5467 and nothing beyond those is needed for this more-limited proposal.

Cost Impact: The code change proposal will increase the cost of construction
While cost of construction will increase, that increase (as shown also in the first proposal on this same topic in a 2003 proposal on stairways in the IRC) pales in comparison to the benefits of the "7-11" step geometry for dwelling unit stairs.

From the Reason Statement (which is the Reason Statement for Proposal 5467) covering all of R311, not just rise and tread depth changes, comes the following updated detail on cost impact in relation to step dimensions.

"If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly $700 per stair flight (or household) per year. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families and individuals."

RB112-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This will limit homeowner and design options. The proponent did not provide information related to accidents that were specific to the code geometry that is now in the code. This should be looked at in more depth by ICC. (Vote: 10-1)

Assembly Action: **None**

RB112-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jake Pauls, representing self (bldguse@aol.com)

requests As Submitted

Commenter's Reason: The ICC IRC-B Committee provided only three reasons for disapproving RB112-19.

The first provided reason is largely without foundation as the additional space for providing a stair meeting the “7-11” standard is relatively small based on the current “7.75-10” standard which only the ICC codes permit (among US model codes). The area difference between the two standards is about the same as the area required for one 90-degree turn landing on a stairway which can, for example, be replaced with a set of tapered treads (e.g. four steps each turning 22.5 degrees) which make more-efficient use of space. Thus planning of the stairway generally allows more effective use of space which, overall for US homes has increased markedly over the last few decades with no comparable improvement in stairway safety and usability.

The second reason is addressed in the referenced shared justification for improved home stairs provided with companion proposal RB116-19. Specifically, there is about a 60 percent reduction (from 50 to 20 hospital emergency department treatments annually per 100,000 population) in injurious fall risk when the stair is improved from the “7.75-10” standard to “7-11” based solely on the one-inch increase in tread depth or run dimension as well as the 0.75-inch reduction in the permitted rise dimension. (See Table 3 of the RB116-19 proposal which is also addressed in a companion public comment to this one. RB116-19 dealt mostly with the improvements gained with the change to the NFPA 101-required “7-11” step dimension (minimum) for home stairs, adopted and maintained since 2003.

The third reason for Committee disapproval was not a reason but a strategy to address the future processing of such code change proposals on home stair step dimensions. I heartedly endorse the Committee’s suggested strategy and would engage my talents and immense library and professional contact resources in making the effort successful.

I will even invest more than providing state-of-the-art advice to a study group or process within ICC. I would welcome any ICC chapter approaching me (at bldguse@aol.com) with a request to provide a custom presentation of a no-charge, half-day workshop to its members on not just the stairway safety issue but that of bathtub and shower safety (as addressed In my IRC proposal IRC81-19 and a public comment). Preferably that could be done prior to the Public Comment Hearings in Las Vegas but, if only possible later, that would be helpful in Chapter demonstration of real concern about these leading home-related injury topics that must be better addressed in ICC codes as well as in code enforcement procedures.

Along with the few people who provided complimentary viewpoints (privately or in public testimony) in Albuquerque on the stairway (and bathtub/shower) shower issues, I endorse having ICC move to the forefront in evidence-based code development, application and professional (as well as building trade) education and training. ICC member support for this comment in Las Vegas would be both appreciated and helpful in addressing a very large and ever-growing public health crisis from predictable and preventable injuries, especially from missteps and falls.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
See proposal RB112-19 for details.

Public Comment# 2113

RB114-19

IRC®: R311.7.8.4 (New)

Proposed Change as Submitted

Proponents: Lucas Pump, City of Cedar Rapids, representing Self (l.pump@cedar-rapids.org)

2018 International Residential Code

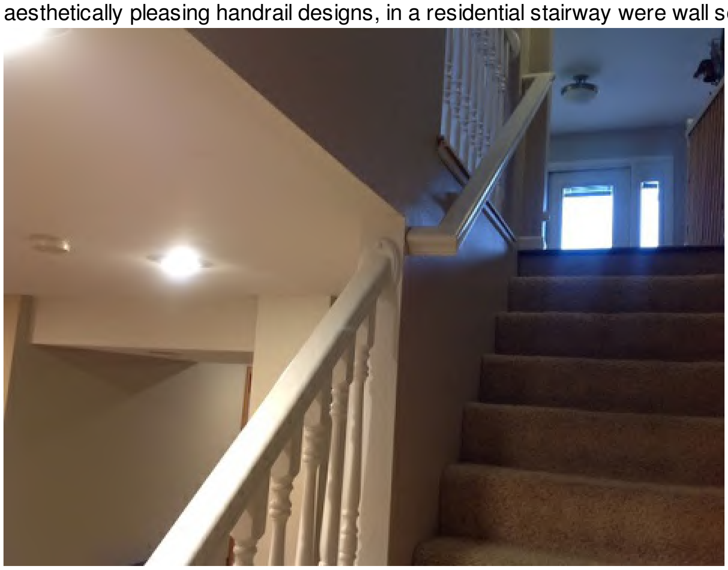
Revise as follows:

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.
3. Offsets or interruptions of six inches or less in total length shall be considered to be continuous.

Reason: This proposal would allow a handrail to terminate at a newel post or a wall section, then start back up. Also, this would allow for more aesthetically pleasing handrail designs, in a residential stairway were wall sections are off-set and would allow for a newel post within the handrail.



Cost Impact: The code change proposal will decrease the cost of construction
This proposal would decrease the cost of construction because the contractor could eliminate the need for some of the handrail offset fittings and elbows.

RB114-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: No technical information has been brought forward for the proposal. The potential for multiple interruptions in this proposal is unsafe. The solution is to move the wall over and allow the wall to go up without interruptions. (Vote: 11-0)

Assembly Action: **None**

RB114-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R311.7.8.4 (New)

Proponents:
Lucas Pump, representing Self (l.pump@cedar-rapids.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.
3. ~~Offsets or interruptions of six inches or less in total length~~ Where the stair guard serves as a handrail that terminates at a wall and it initiates again within four inches, the handrail shall be considered ~~to be~~ continuous.

Commenter's Reason: I believe that this public comment fixes the concerns that were brought up during the Committee Action Hearings by adding the modification into the exceptions, instead of into the body of the code. Also, this solves a real world problem, as the "S" fitting does more harm than good and is not practical, as nobody drags there hand continually up the handrail around an "S" fitting, as a person walks up the stairs they pick up there hand and grab the handrail as they go. Another concern that was brought up was the fact that the original proposal didn't limit the amount of interruptions, and this makes it clear on the exact location in which you can interrupt it.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code change would eliminate the need for the "S" fitting at the section where the guardrail ends, and handrail starts at a wall section.

Public Comment# 1151

RB115-19

IRC®: R311.7.8.4

Proposed Change as Submitted

Proponents: Stephen Thomas, Colorado Code Consulting, LLC, representing Himself (sthomas@coloradocode.net)

2018 International Residential Code

Revise as follows:

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts ~~or safety terminals.~~

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.

Reason: Ther term saftety terminal is for commercial handrails that need to comply with the projecting elements requirements for the means of egress and accessibility. It is also not a defined term in the IRC. Many people don't know what a safety terminal is. Therefore, the language is not needed in the IRC and should be deleted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will have not an impact on the construction. It is deleting language that is not needed in the IRC.

RB115-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned <u>toward a wall, guard or walking surface</u>, or shall terminate in newel posts

Exceptions:

1. 1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. 2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread <u>and over the top landing</u>.

Committee Reason: This proposal provides more design options. The proposal does not work without the modifications. The modifications improve consistency between the IRC & IBC. (Vote: 11-0)

Assembly Action: **None**

RB115-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R311.7.8.4

Proponents:
Emma Gonzalez-Laders, representing NYS Department of State (emma.gonzalez-laders@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard,or walking surface, or shall terminate ~~in newel~~ at a posts.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

Commenter's Reason: RB115-19 should be Approved As Modified by this public comment. The proposal as written is too restrictive by eliminating the possibility of terminating a handrail at a post or column. This modification would clearly permit posts and columns, as well as newel posts. This is supported by the first entry under the common definition of the word "post" found in the Merriam Webster online dictionary and here quoted:
"Post. Noun.

*1: a piece (as of timber or metal) fixed firmly in an upright position especially as a stay or support **:** PILLAR, COLUMN."*

Bibliography: 1. “Post.” Def.1. www.merriam-webster.com/dictionary/post. Merriam-Webster Dictionaries, (n.d.). Web. 24 July 2019.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a clarification of the proposed code change.

Public Comment# 2002

Public Comment 2:

IRC®: R311.7.8.4

Proponents:
Thomas Zuzik Jr, of Railingcodes.com, Representing NOMMA – The National Ornamental and Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellanuous Metals Association (coderep@railingcodes.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard,~~or~~ walking surface, continuous to itself or ~~shall~~ terminate to a ~~in newel~~ posts.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

Commenter's Reason: The proponent of RB115-19 both at the spring CAH and in their reason statement incorrectly stated **"the language is not needed in the IRC and should be deleted"**
A large majority of common metal handrail terminations currently fall under the term "Safety Terminal” from R311.7.8.4 within the code. By removing this terminology from the code it creates many conflicts with commonly used ornamental metal handrail terminations that were previously covered under the umbrella term “Safety Terminal”.
The proponent of RB115-19 worked with others on the floor at the CAH and a modification was submitted to the original proposal and the committee approved RB115-19 as modified to exception 2, adding “and over the top landing” in an effort to encompass the same types of terminations that are

allowed over the bottom tread to be allowed over the top landing.

Even with the exception modification, the new language still falls very short and eliminates many previously allowed safe, safety terminations. This submitted public comment modification to the committee approved code proposal RB115-19 is presented to repair these over-sites before the code change becomes formal as explained in more detail here.

1. In the ornamental metal industry, there are two types of commonly used terminations that are noted as ending, but not ending. The first is best described as the racetrack handrail termination, this is commonly used down the center of stair flights where no guard is required or installed. You have a handrail on each side of a center post structure, and the handrail molding returns and is continuous to itself, both at the top and bottom landings establishing the safety terminal. (See Picture RCNOMMA-01.png)

2. The next commonly used ending non ending termination is a vertical continuous loop on each end of again a handrail molding set on posts and not a part of a guard. At each end, the handrail returns into a continuous loop establishing the safety terminal. (See Picture RCNOMMA-02.jpg)

3. The last modification is the removal of the word “newel” in conjunction with the term post. Many colonial type homes and other similar type homes commonly terminate into a full height column or full height trellis architectural type feature at the top and bottom of stair flights and this termination type was covered under the umbrella term “Safety Terminal”. Under the new language which removes “safety terminal” from the code, a column or trellis is not listed and nor is it any of the currently listed “Wall, Guard, Walking Surface, Newel Post” or the new description noted above in this modification “Itself”. Thus by removing "newel" from the language a column or the post in a trellis structure can be defined or referred to simply as a post and still encompass the termination that was previously allowed under the umbrella term “Safety Terminal” without adding to the laundry list. Where as per the new language the termination is deemed non-compliant or at best enters the guessing game of is it allowed or not based solely on if it is similar to a newel post in feature when it terminates? (See Pictures RCNOMMA-03 Column.jpg & RCNOMMA-04 Trellis.jpg)

For the reasons stated we request that you approve this modification by public comment to fix the original proponent's removal of compliant terminations, because his reason statement incorrectly states "will not change anything" but does drastically change many commonly used terminations from being compliant moving forward.

Bibliography: Pictures supplied by NOMMA Membership

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This proposed modification is centered on safe and compliant handrails terminations to continue to be used, where the current committee approved

code change cost statement is incorrect in stating there is no cost increase, when there is cost change. This public comment will return the cost effect to the original lower cost.

Public Comment# 1582

Public Comment 3:

Proponents:
Thomas Zuzik Jr, of Railingcodes.com, Representing NOMMA - The National Ornamental and Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellanuous Metals Association (coderep@railingcodes.com)

requests Disapprove

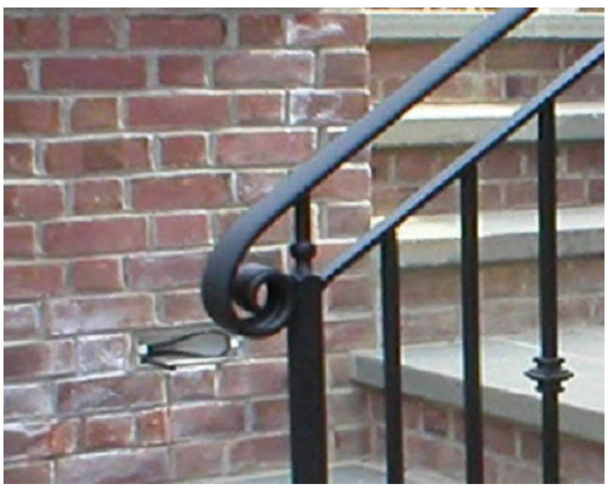
Commenter's Reason: The proponent of RB115-19 both at the spring CAH and in their reason statement, we believe, incorrectly stated **"the language is not needed in the IRC and should be deleted" and also incorrectly stated "will have no impact on the construction"**
A large majority of common metal handrail terminations currently fall under the term "Safety Terminal" from R311.7.8.4 within the code. By removing this terminology from the code it creates many conflicts with commonly used ornamental metal handrail terminations that were previously covered under the umbrella term "Safety Terminal".
The proponent of RB115-19 worked with others on the floor at the CAH and a modification was submitted to the original proposal and the committee approved RB115-19 as modified to exception 2, adding "and over the top landing" in an effort to encompass the same types of terminations that are allowed over the bottom tread to be allowed over the top landing.
However, even with modification to exception 2, the new language still falls extremely short and eliminates many previously allowed safe, safety terminations. The following information is presented for review to explain the conflicts the change in wording produces without adding additional information before removing the term "Safety Terminal" from the code.

1. In the ornamental metal industry, there are two types of commonly used terminations that are noted as ending, but not ending. The first is best described as the racetrack handrail termination, this is commonly used down the center of stair flights where no guard is required or installed. You have a handrail on each side of a center post structure, and the handrail molding returns and is continuous to itself, both at the top and bottom landings establishing the safety terminal by continuing on to itself. (See Picture RCNOMMA-01.png)

2. The next commonly used ending non ending termination is a vertical continuous loop on each end of again a handrail molding set on posts which is not a part of a guard or guard system. At each end, the handrail returns into a continuous loop establishing the safety terminal on each end. (See Picture RCNOMMA-02.jpg)

3. Next it seems everyone always forgets that there are many types of architectural features that handrails terminate into that are not listed in the so called all inclusive list. Two of those terminations are into a column or trellis. These terminations are not into walls, guards or walking surfaces, and many times have been questioned and then commented on well does not the column or trellis return to the floor, hence compliant, however the simplest direction to compliance was it is a SAFE TERMINATION and therefore complies as a Safety Terminal. (See Pictures RCNOMMA-03 Column.jpg & RCNOMMA-04 Trellis.jpg)

4. However, the one termination that will get the most resistance will be the Vertical Volute. Many inspectors still argue with metal fabricators that a volute is just a horizontal wood scroll turnout over the bottom tread of a stair flight and not vertical. The metal handrail fabricators most widely used termination is a vertical volute as pictured below in the (4) examples. These handrail terminations are centuries old and the majority are formed to a specific die set, Makers Mark, of the fabricator themselves. Routinely approved by inspectors under the "Safety Terminal" provision of the code and not through exception 2. The vertical volute termination is one of the most economic and widely used metal safety terminals.



For the reasons stated we request dis-approval and NOMMA will reach out to work with the Proponent of RB115-19 to come to a more defined language for the next code cycle. As, we believe the proponent, has unintentionally incorrectly stated the proposal will not change anything, but does drastically change many commonly used terminations from being compliant moving forward.

Bibliography: Pictures by NOMMA Membership

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# 1719

RB116-19

IRC®: R311.7, R311.7.1, R311.7.2, R311.7.3, R311.7.4, R311.7.5, R311.7.5.1, R311.7.5.2, R311.7.5.2.1, R311.7.5.3, R311.7.6, R311.7.7, R311.7.8, R311.7.8.1, R311.7.8.2, R311.7.8.3, R311.7.8.4, R311.7.8.5, R311.7.10.1, R311.7.6.1, R311.7.6.2, R311.7.7.1, R311.7.7.2

Proposed Change as Submitted

Proponents: Jake Pauls, Jake Pauls Consulting Services, representing self (bldguse@aol.com)

2018 International Residential Code

R311.7
Stairways.

Revise as follows:

R311.7.1 ~~Width.~~ Stairways. Stairways shall ~~be not less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. The clear width of stairways at and below the handrail height, including treads and landings, shall be not less than 31 1/2 inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are installed on both sides.~~ comply with NFPA 101-2018 Section 24.2.5.

~~**Exception:** The width of spiral stairways shall be in accordance with Section R311.7.10.1.~~

Delete without substitution:

~~**R311.7.2 Headroom.** The headroom in stairways shall be not less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.~~

~~**Exceptions:**~~

~~1.Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall not project horizontally into the required headroom more than 4 3/4 inches (121 mm).~~
~~2.The headroom for spiral stairways shall be in accordance with Section R311.7.10.1.~~

~~**R311.7.3 Vertical rise.** A flight of stairs shall not have a vertical rise larger than 151 inches (3835 mm) between floor levels or landings.~~

~~**R311.7.4 Walkline.** The walkline across winder treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where winders are adjacent within a flight, the point of the widest clear stair width of the adjacent winders shall be used.~~

~~**R311.7.5 Stair treads and risers.** Stair treads and risers shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.~~

~~**R311.7.5.1 Risers.** The riser height shall be not more than 7 3/4 inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open risers, openings located more than 30 inches (762 mm), as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.~~

~~**Exceptions:**~~

~~1.The opening between adjacent treads is not limited on spiral stairways.~~
~~2.The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.~~

~~**R311.7.5.2 Treads.** The tread depth shall be not less than 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).~~

~~**R311.7.5.2.1 Winder treads.** Winder treads shall have a tread depth of not less than 10 inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than 3/8 inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within 3/8 inch (9.5 mm) of the rectangular tread depth.~~

~~**Exception:** The tread depth at spiral stairways shall be in accordance with Section R311.7.10.1.~~

~~**R311.7.5.3 Nosings.** Nosings at treads, landings and floors of stairways shall have a radius of curvature at the nosing not greater than 9/16 inch (14~~

~~mm) or a bevel not greater than $^{1}/_{2}$ inch (12.7 mm). A nosing projection not less than $^{3}/_{4}$ inch (19 mm) and not more than $1^{1}/_{4}$ inches (32 mm) shall be provided on stairways. The greatest nosing projection shall not exceed the smallest nosing projection by more than $^{3}/_{8}$ inch (9.5 mm) within a stairway.~~

> ~~**Exception:** A nosing projection is not required where the tread depth is not less than 11 inches (279 mm).~~

Revise as follows:

~~**R311.7.5.4**~~ **R311.7.2 Exterior plastic composite stair treads.** Plastic composite exterior stair treads shall comply with the provisions of this section and Section R507.2.2.

Delete without substitution:

~~**R311.7.6 Landings for stairways.** There shall be a floor or landing at the top and bottom of each stairway. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the depth in the direction of travel shall be not less than 36 inches (914 mm).~~

> ~~**Exception:** A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided that a door does not swing over the stairs.~~

~~**R311.7.7 Stairway walking surface.** The walking surface of treads and landings of stairways shall be sloped not steeper than one unit vertical in 48 inches horizontal (2-percent slope).~~

~~**R311.7.8 Handrails.** Handrails shall be provided on not less than one side of each flight of stairs with four or more risers.~~

~~**R311.7.8.1 Height.** Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).~~

~~**Exceptions:**~~

~~1.The use of a volute, turnout or starting easing shall be allowed over the lowest tread.~~
~~2.Where handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to *guard*, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed 38 inches (956 mm).~~

~~**R311.7.8.2 Handrail projection.** Handrails shall not project more than $4^{1}/_{2}$ inches (114 mm) on either side of the stairway.~~

> ~~**Exception:** Where nosings of landings, floors or passing flights project into the stairway reducing the clearance at passing handrails, handrails shall project not more than $6^{1}/_{2}$ inches (165 mm) into the stairway, provided that the stair width and handrail clearance are not reduced to less than that required.~~

~~**R311.7.8.3 Handrail clearance.** Handrails adjacent to a wall shall have a space of not less than $1^{1}/_{2}$ inches (38 mm) between the wall and the handrails.~~

~~**R311.7.8.4 Continuity.** Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.~~

~~**Exceptions:**~~

~~1.Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.~~
~~2.A volute, turnout or starting easing shall be allowed to terminate over the lowest tread.~~

~~**R311.7.8.5 Grip size.** Required handrails shall be of one of the following types or provide equivalent graspability.~~

~~1.Type I. Handrails with a circular cross section shall have an outside diameter of not less than $1^{1}/_{4}$ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular, it shall have a perimeter of not less than 4 inches (102 mm) and not greater than $6^{1}/_{4}$ inches (160 mm) and a cross section of not more than $2^{1}/_{4}$ inches (57 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).~~
~~2.Type II. Handrails with a perimeter greater than $6^{1}/_{4}$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within $^{3}/_{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and have a depth of not less than $^{5}/_{16}$ inch (8 mm) within $^{7}/_{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $^{3}/_{8}$ inch (10 mm) to a level that is not less than $1^{3}/_{4}$ inches (45 mm) below the tallest portion of the profile. The width of the handrail above the recess shall be not less than $1^{1}/_{4}$ inches (32 mm) and not more than $2^{3}/_{4}$ inches (70 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).~~

Revise as follows:

~~**R311.7.8.6**~~ **R311.7.3 Exterior plastic composite handrails.** Plastic composite exterior handrails shall comply with the requirements of Section

R507.2.2.

~~**R311.7.9**~~ **R311.7.4 Illumination.** Stairways shall be provided with illumination in accordance with Sections R303.7 and R303.8. The illumination system shall be capable of providing a minimum of 10 foot-candles (110 lux), measured at the center of stairway landings and treads, when the stairway is in use.

~~**R311.7.10**~~ **R311.7.5 Special stairways.** ~~Spiral stairways and bulkhead~~ Bulkhead enclosure stairways shall comply with the requirements of ~~Section R311.7 except as specified in Sections R311.7.10.1 and R311.7.10.2.~~ NFPA 101-2018 Section 24.2.2.3.

Delete without substitution:

~~**R311.7.10.1 Spiral stairways.** The clear width at and below the handrails at spiral stairways shall be not less than 26 inches (660 mm) and the walkline radius shall be not greater than $24^{1}/_{2}$ inches (622 mm). Each tread shall have a depth of not less than $6^{3}/_{4}$ inches (171 mm) at the walkline. Treads shall be identical, and the rise shall be not more than $9^{1}/_{2}$ inches (241 mm). Headroom shall be not less than 6 feet 6 inches (1982 mm).~~

~~**R311.7.10.2 Bulkhead enclosure stairways.** Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside *grade* level to the *basement* shall be exempt from the requirements of Sections R311.3 and R311.7 where the height from the *basement* finished floor level to *grade* adjacent to the stairway is not more than 8 feet (2438 mm) and the *grade* level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other *approved* means.~~

Revise as follows:

~~**R311.7.11**~~ **R311.7.6 Alternating tread devices.** Alternating tread devices shall not be used as an element of a means of egress. Alternating tread devices shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).

> **Exception:** Alternating tread devices are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m^2) or less where such devices do not provide exclusive access to a kitchen or bathroom.

~~**R311.7.11.1**~~ **R311.7.6.1 Treads of alternating tread devices.** Alternating tread devices shall have a tread depth of not less than 5 inches (127 mm), a projected tread depth of not less than $8^{1}/_{2}$ inches (216 mm), a tread width of not less than 7 inches (178 mm) and a riser height of not more than $9^{1}/_{2}$ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

~~**R311.7.11.2**~~ **R311.7.6.2 Handrails of alternating tread devices.** Handrails shall be provided on both sides of alternating tread devices and shall comply with Sections R311.7.8.2 to R311.7.8.6. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

~~**R311.7.12**~~ **R311.7.7 Ships ladders.** Ships ladders shall not be used as an element of a means of egress. Ships ladders shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches.

> **Exception:** Ships ladders are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m^2) or less that do not provide exclusive access to a kitchen or bathroom.

~~**R311.7.12.1**~~ **R311.7.7.1 Treads of ships ladders.** Treads shall have a depth of not less than 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is not less than $8^{1}/_{2}$ inches (216 mm). The riser height shall be not more than $9^{1}/_{2}$ inches (241 mm).

~~**R311.7.12.2**~~ **R311.7.7.2 Handrails of ships ladders.** Handrails shall be provided on both sides of ships ladders and shall comply with ~~Sections R311.7.8.2 to R311.7.8.6. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).~~ Section R311.7.1.

Reason: Introduction. Over the last two decades, covering the entire history of the *International Residential Code,* subsection R311.7 on stairways—*which started with some serious defects*—has not improved as much as warranted by the home stair-related injury toll, especially the toll's growth over the last two decades. This proponent sees little value in addressing, *in detail*, all of the IRC's deficits with regards to stairways unless there are major changes in how ICC members and committees understand and address the overarching topic of home step dimensions, handrail requirements, etc., with step dimensions being the most potent set of factors impacting both home stairway usability and safety. Thus the best strategy is to propose a substitution of most of the IRC's stairway requirements with a reference to NFPA 101's Chapter on One and Two-Family Dwellings.

The justification for this drastic proposal is technical as well as procedural, with emphasis below on the technical issues. Addressing the procedural issues would mean going into detail on the overarching role of two organizations in the development, to date, of the IRC's stairway requirements, namely the National Association of Home Builders (NAHB) and the Stairway Manufacturers Association (SMA).

Neither of these organizations have been participating actively in all the research conducted over the last five decades in several countries, most notable of which are the USA, the UK , Japan and Canada. Such participation clearly sets the proponent of this substitution apart from the NAHB and

SMA, both organizationally and in terms of any individual in these organizations (now and in the past three decades).

The proponent's participation entails formal research (for 20 years at the National Research Council of Canada), international consulting (for four decades), ergonomics certification (since 1993, with re-certifications in 2010 and 2015), and public health involvement (as the lead, formal/voting representative for the American Public Health Association, APHA, on eight ICC and NFPA committees dating back two decades). His publications record includes about 100 publications on stairway use, safety and design. His record of formal presentations worldwide includes over 100 on stairways beginning in 1974. His record production of educational and documentary videos include over 30 videos and one documentary film, "The Stair Event" (the only such film on stairways, produced 40 years ago).

No individual, organization or any collection of these, can match the proponent's record of scientific and technical accomplishments since 1967 which has resulted in several awards and an Honorary Doctor of Science degree. These reflect international recognition focused most intensively in three countries, the USA (his longest base of activity), Canada and the UK.

Moreover, the proponent is relatively well known by premises liability attorneys in the US and Canada who represent persons injured on stairways or, in a minority of cases, attorneys representing premises owners and operators. Some of the latter, rather than being defendants, are corporate counsel for very large organizations with multiple facilities where stairway safety has been a major concern and the organization wishes to take a pro-active approach to injury prevention. In Canada, due to the premises liability laws there, the proponent's litigation-related work focuses much more on one- and two-family dwellings than is the case in the USA where the home stairway dangers are almost as bad as in Canada—especially in relation to stair step dimensions, but there has been less litigation focused on the comparable dangers to stairway users.

Bottom line: much has been learned over the last four decades especially that draws on multiple sources of insight on the real dangers of stairways and the need for model code organizations, adopting authorities and enforcing officials to recognize just how devastating the home stairway-related injury ***endemic*** has become. Only NFPA has responded realistically to the home stairway-related endemic. ICC has had the opportunity to do so over the last 20 years but it has failed, very badly, to respond to the public health and safety situation. ***This has to change!***

A**nalogy connecting stairways and automobiles.** For readers who are put off by technical and other details, please read the following sentences about an apt comparison. Imagine the outcry that would have occurred if, starting decades ago, the automobile industry adopted, and implemented, a policy of only providing brakes for vehicles that were only used by relatively fit, working-age adults. For everyone else—e.g., children and older adults—vehicles would not be provided with functional brakes or steering that worked reliably for people with widely varying strength abilities. Of course the automobile industry—internationally (partly following developments in the USA)—took a different path, a path to cars that were not only safer, for example with brakes and steering systems, but were much more functional. These and other systems served a wide range of drivers and occupants in ALL use conditions, not only crashes, emergency stopping and control but for normal operational usability.

Through the decades, while the automobile industry adopted more progressive policies—*partly dictated by laws and regulations*—the building industry has steadfastly avoided clear evidence that home stairway-related falls were growing faster than population growth and costs of stair-related injuries vastly exceeded the initial costs of stairway construction. Indeed the building industry operated oblivious of scientific knowledge and other evidence.

APHA Policies on Building Codes. Since the turn of the century, ICC has diverged from NFPA's far more evidence-based approach to ALL stairways, notably those in homes, as well as repeated public policies adopted by the American Public Health Association (APHA).

- APHA Policy Statement 99-16, Public Health Role of Codes Regulating the Design, Construction and Use of Buildings
- APHA Policy Statement 2000-19, Public Health Role of the National Fire Protection Association in Setting Codes and Standards for the Built Environment
- APHA Policy Statement 200913, Building Code Development, Adoption, and Enforcement Problems Affecting Injury Prevention in, and Usability of, Homes and Other Buildings.

Here is what the last in this series, the currently active APHA policy 200913, stated:

> "From ICC's beginnings, there were indications that public health was not as high of a priority for the ICC, as was a dominating business presence in the US building regulatory field. This concern regarding the relationship between the ICC and the National Association of Home Builders (NAHB) was first addressed in APHA Policy 99-16 and reiterated in APHA Policy 2000-19. When the longer-established National Fire Protection Association (NFPA), with its very large set of widely used safety standards, decided to develop a competing model building code, APHA adopted policy statement 2000-19 to help influence NFPA in a more public health–oriented approach to model building code development. . . .
>
> Much of what was recommended to NFPA in APHA's policy 2000-19 was implemented in NFPA codes and standards during the next several years, including, in 2003, mainstreamed safety and usability requirements for the most dangerous element in homes, the stairways. . . .
>
> The model code development process, especially within ICC's system of public hearings, is based on a model encouraging adversarial testimony and other formal input to the process. Certain issues typically pit advocates for public health goals (such as safety and accessibility or usability of the built environment) against certain industry representatives whose goals are to have little or no change in established, traditional practices; to experience minimal regulatory interference; and to claim often that housing affordability will be harmed. . . .
>
> As a general rule, there is no epidemiological or etiological basis for the traditional double, lower standard for home stair step geometry or for inferior handrail provision or functional quality; this was a point made explicitly in APHA's Policy 2000-19. NFPA has taken this issue to heart in its post-2000 revisions to its leading codes; ICC has gone in the opposite direction, increasing the gulf of safety and usability levels between home stairways and those in other settings. . . .
>
> **Therefore the APHA recommends:** . . . . 5. ICC and NFPA should develop and maintain model codes and standards requiring

home stairways to be designed and constructed so that stairs and railings provide at least the same level of usability and safety from falls as do stairs and railings in other buildings."

Now, almost two decades after ICC published first editions of the IBC and IRC, ICC continues to ignore the evidence of stairway safety issues as well as the formally adopted policies of the American Public Health Association, APHA. Here follow highlights of that evidence, including Injury Epidemiology and Etiology.

Injury Epidemiology

Stairways. Since 2002, approximately the time that the IRC began to influence home stairway construction, medically-treated injuries in all settings—sufficient to lead to hospital emergency room visits—*increased by about 39 percent as of 2017 in the USA.* (This equates to a growth rate of about 2 percent a year over the 15-year period.) During this 15-year period, US population only increased by about 13 percent, that is with a demographic growth only about one-third that of stair-related injuries.

Also during this period there appears to have been an increase in the proportion of stairway related injuries occurring in home settings for which the location data are not as complete. For known locations, the home-based proportion has increased from about 85 percent to about 90 percent or higher over the 15-year period.

Stairs Compared to Fires. During this same 15-year period, *fire-related fatalities* in all US settings—with homes again being the most common site of fatalities—*decreased* with the approximate rate, per 100,000 population dropping from about 1.3 to about 0.98 injuries annually per 100,000 US population.

Comparison of stair-related *injuries* with fire-related *injuries* is complicated by the lack of detail about the nature of treatment needed for the fire-related injuries. For stair-related injuries, that are professionally treated, the treatment rates per 100,000 US population are displayed in Table 1 for the annual averages over the years 2010 to 2014: the average injury rate was about 1,400 per 100,000 population. At about the same time, fire-related injuries (based on 2016 figures from the US Fire Administration) had a rate of about 45 injuries per 100,000 and they were declining. (The resulting ratio of stairways to fire is about 31, a factor depicted in Figure 1.) There were some age differences for fires with rates of 55 for middle-age adults, 25 for children and 45 for older adults, all per 100,000 population. By contrast, during the period 2010-2014, *annual rates* for stair-related injuries, per 100,000 population, that resulted in professional medical care, are described in more detail in Table 1, right to left: for Doctors Offices or Outpatient Clinics, for Emergency Departments, and for Hospital Admission.

Stairs			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	369.2	327.1	10.7	3.7	710.8
10-19	569.9	290.6	5.4	2.0	867.8
20-29	962.0	453.2	10.6	3.5	1,429.2
30-39	1,381.9	454.3	13.9	4.7	1,854.8
40-49	1,489.6	406.3	21.7	7.2	1,924.8
50-59	1,164.3	342.9	34.6	11.9	1,553.6
60-69	905.9	298.2	52.3	17.8	1,274.2
70-79	981.6	374.4	101.2	34.1	1,491.3
>=80	917.0	478.0	200.4	54.7	1,650.1
Total	980.5	374.5	31.5	10.2	1,396.7

Table 1. Annual US Injury Rates for Stairs (per 100,000 population), by treatment and age, during 2010-2014

(Source: Pacific Institute for Research and Evaluation, Maryland)

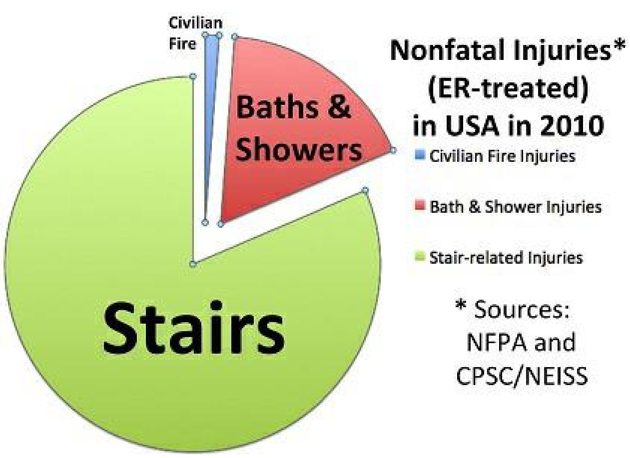


Figure 1. Chart of Approximate Relative Occurrence of Serious Injuries Associated with Three Common Dangers in Homes and Other Buildings

Comparing these stairway-related rates, with their enhanced specificity, in Table 1, with those noted earlier for fires, we should note the much larger public safety problem posed by stairways, compared to fires. From Figure 1 we should recognize that there is great disparity of code response to injury occurrence for stairways, along with another badly neglected topic in the IRC, fall prevention for bathtubs and showers (the subject of another set of proposed changes to the IRC).

To fully appreciate the size of the stairway safety problem in the USA, Table 2 provides estimates of incidence, annually, of injuries by treatment type and victim age.

Stairs			Hospital-admitted		
Age	Doc/Outp	ED	via ED	Direct	Total
00-09	149,389.0	132,344.0	4,313.0	1,515.8	287,561.8
10-19	240,132.0	122,449.0	2,288.5	824.6	365,694.1
20-29	422,114.0	198,838.0	4,634.7	1,533.7	627,120.4
30-39	560,978.0	184,438.0	5,628.9	1,910.3	752,955.2
40-49	634,787.0	173,156.0	9,241.0	3,050.3	820,234.3
50-59	502,896.0	148,100.0	14,928.3	5,133.4	671,057.7
60-69	286,908.0	94,429.1	16,556.9	5,644.9	403,538.9
70-79	173,515.0	66,176.8	17,891.0	6,021.7	263,604.5
>=80	106,489.0	55,507.0	23,272.4	6,356.7	191,625.1
Total	3,077,207.0	1,175,439.0	98,754.8	31,991.4	4,383,392.2

Table 2. Annual US Injury Incidence for Stairs
by treatment and age, during 2010-2014
(Source: Pacific Institute for Research and Evaluation, Maryland)

The overall total, of over 4 million professionally treated injuries annually in the USA (within the period, 2010-2014), related to stairways, is mind blowing as is the huge societal cost of such injuries. During 2010-2014, the average *annual* societal cost of stairway-related injuries in the USA was estimated as over $92 billion (2009 US dollars) and the vast majority of those injuries were in homes. (Source: Lawrence, B., Spicer, R., Miller, T. A fresh look at the costs of non-fatal consumer product injuries. *Injury Prevention,* digital publication, August 2014, paper journal publication, 2015:**21**:23-29.0)

Some Preliminary Cost-Benefit Insights. If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly $700 per stair flight (or household) *per year*. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families and individuals. Why this is the case is discussed in the next section, on etiology, the study of causes (of bad events such as disease, injuries, etc.).

Injury Etiology for Stairways

There is widespread agreement—*about the very prominent, indeed central role of stair step dimensions (among several stairway design and construction factors)*—among all the experts on stairway safety who have researched the topic and have been lead authors of papers, book chapters, a book or producer of widely viewed, edited video programs. Many have worked at, or for, the leading building science and technology centers in Japan, Britain, Australia, Sweden, Canada and the USA during the last six decades. All of the following individuals, listed alphabetically, have addressed various aspects of stairway use, safety and design; all have published authoritatively on one or more of these topics. Most have had long-term contact with the proponent. ***All favor improvements in stairway design to reduce the toll of injuries seen internationally over the last several decades***.

- Dr. John Archea (deceased), USA
- Dr. Susan Baker (retired)
- Dr. Ben Barkow, USA and Canada
- Dr. Peter Barss, MD, Canada
- Dr. Michael Brill (deceased), USA
- Dr. Daniel Carson (deceased), USA
- Dr. Harvey Cohen, (retired) USA
- Dr. Nancy Edwards, Canada
- Dr. Nigel Ellis, USA
- Dr. Geoff Fernie, USA
- Dr. John Fruin, (retired) USA
- Dr. Tom Hay, Canada
- Dr. Charles Irvine (deceased), USA
- Dr. Daniel Johnson, USA

- Dr. Satoshi Kose, (retired) Japan
- Dr. Lennart Kvanstrom (deceased), Sweden
- Dr. Hamish MacLennan, Australia & New Zealand
- Dr. Hisao Nagata, (retired) Japan
- Dr. Alison Novak, Canada
- Dr. Marcus Ormerod, UK
- Dr. Joan Ozanne-Smith, Australia
- Dr. Jake Pauls, Canada & USA
- Mr. Mike Roys, UK
- Dr. Gary Sloan, (retired) USA
- Dr. Edward Steinfeld, USA
- Dr. Leif Svanström, Sweden
- Dr. John Templer, (retired) USA
- Dr. Keith Vidal, USA
- Dr. Michael Wright, UK

Both Sides of the "7-11" Proposal for Home Stairs Debated. There are relatively few people who have argued on the reactionary, industry side of the long-running debate about improving the design of stairways. One published example of an extended debate on the topic of improved home step dimensions dates back to 1985 (Dacquisto, D.J. and Pauls, J., 1985, The "7-11" stair: Should it be required for residential construction? *The Building Official and Code Administrator,* May-June, pp. 16-35.) David Dacquisto represented the National Association of Home Builders in this published debate. Jake Pauls represented scientific plus technical perspectives, e.g., based on research and public health evidence. The "Yes" side of published, 12-page account of the debate, in the BOCA magazine, was based on an 8,000-word position paper by Pauls.

Here follow concluding remarks in both sides' lengthy arguments, with Pauls' remarks selected for roughly comparable length and subject focus:

Dacquisto, for the NAHB. "What should be the standard for deciding whether to adopt a code proposal which faces opposition? Both cost and benefit estimates will always be uncertain. A suggested minimum standard is that no regulatory proposal should be finally approved over opposition unless the regulatory body finds it more likely than not that benefits of the proposal will exceed the costs, and believes there is probably no less costly way to achieve the anticipated benefits. The burden of proof should be on the proponent. By this standard, for the reasons presented in this article, the residential 7/11 stair proposal appears unwarranted at the present time."

> **Pauls, for many experts and consumers** ". . . Clearly, judging from the technical literature, the disagreement among apparently, "reasonable people" is certainly not great enough to give any real comfort to those trying to justify continuation of very poor step geometry standards for residential stairs. Also, despite Mr. Dacquisto's apparent attempts to conceal the fact, literature produced by "reasonable people" generally calls for residential stair geometry that is similar to and sometimes better than, what is expected elsewhere. . . ."

Today, over three decades after the above debate, the evidence has grown significantly, *both from epidemiology and etiology*, for improving home step dimensions, specifically to the "7-11" standard—with maximum 7-inch rise and minimum 11-inch tread depth or run. Mr. Daquisto's criterion (for "7-11" adoption) about evidence, "that benefits of the proposal will exceed the costs," has been repeatedly provided, including being the lead subject in Pauls' IRC proposal, *in 2003,* for the "7-11" rule—*submitted sixteen years and five editions of the IRC ago—16 years including over 40 million US stair related injuries and about $900 billion in US stair-related, societal injury costs!*

During the 16 years, specifically 2010, Jake Pauls attempted a second set of proposals to update both the IBC and the IRC with respect to home stairway safety, specifically the step dimension rules. That led to a formal appeal to ICC after which the ICC Board refused to deliberate on the matter with the appellant and his counsel. ICC's refusal to properly address the home stairway safety issue extends right to the top of the organization.

This era of three major attempts to change the ICC codes requirements will end with the current proposal in 2019 after which the effort will be moved —painfully for ICC, the building regulatory field, the building industry, and others—increasingly into the litigation arena as has already gained some momentum in Canada where a significant portion of forensic assignments (of the proponent's, especially in Ontario) are now in home settings in relation to injuries due to defective stairs.

History within ICC — 2003. The first major public proposal in March 2003, by Jake Pauls, to ICC to change the IRC home stair step dimension requirements to the "7-11" standard was over 18,000 words in length. In addition to epidemiology and etiology aspects of the issue, the proposal dealt extensively with benefit-cost and other issues.

Here is the outline of the entire proposal.

- ICC Public Proposal Form identifying proponent, etc.
- Legislative Text of Proposed Changes (to sections similar to those now addressed).
  - R311.5.3 Stair treads and risers.
    - R311.5.3.1 Riser height.
    - R311.5.3.2 Tread depth.
    - R311.5.3.3 Profile.
- Benefit-Cost Analysis for Improved Stairs in the USA

- Injury Epidemiology
- History of Debate on Improved Step Geometry Requirements in Codes & Standards
- Benefits and Costs
- Industry's and Regulators' Reviews of Research
- Latest Research on Step Geometry from Britain

- ## Politically-driven Local and State Adoption Process

- Building and Marketing Improved Stairs
- The Problem of the Double Standard
- Intimidation of Building Officials
- Roles of NFPA and APHA
- Summary

Some of these topics are still as relevant today as they were in 2003 and a brief update on these is provided below. Nearly an identical proposal was submitted to NFPA in parallel with the ICC proposal during 2003. An NFPA task group was set up to advise on the issue; it strongly recommended adoption. A rule about 7-11 stairs across the board—especially in homes—was adopted. NAHB appealed and lost. Since then NAHB has given up trying to get the NFPA dwelling unit requirements to revert to what the IRC has. Rather, NAHB turned its efforts to stopping NFPA and others from improving home safety through model code adoption at state and local levels in the USA. ICC appeared to be a willing partner in this effort. Ethics apparently took a back seat as ICC continued to give NAHB a guaranteed one-third of the relevant IRC committee's 12 positions and thus needed only two votes to stop any proposal it did not like. Proponents require 7 votes. The math is clear, as is the need for legal intervention where evidence is treated in much higher regard and nobody with a pre-determined position is allowed to serve as a trier of fact, such as a judge or jury member.

NAHB's Political Opposition Spanning Over Two Decades. The 2003 proposal was not accepted by ICC, largely for what will be termed "political considerations" namely that ICC was not prepared to go against NAHB's bullying (and other forms of power-based influence) against ICC and building officials generally. Indeed, the political power of the NAHB continues, with ICC's apparent *and effective blessing*, two decades after NAHB adopted, in 1996, a policy that stated:

"NOW THEREFORE BE IT RESOLVED that the National Association of Home Builders recommends that all state and local governments who adopt the National Building Code (BOCA) and the Council of American Building Officials (CABO) model building codes, postpone the adoption of any new stair geometry,

> BE IT FURTHER RESOLVED that the National Association of Home Builders recommends that all state and local governments who automatically adopt BOCA and CABO model building codes, amend the 1996 and 1995 editions respectively to continue the use of the 1993 BOCA and CABO model codes as they relate to stair geometry provisions,
>
> BE IT FURTHER RESOLVED that the National Association of Home Builders urges all state and local affiliated Home Builders' Associations to contact state and local code authorities and persuade them to postpone the adoption of the new CABO and BOCA stair geometry standard, and
>
> BE IT FURTHER RESOLVED that the National Association of Home Builders continue to vigorously pursue the adoption of a stair geometry standard consistent with the 1993 BOCA Code."

The 1993 *BOCA National Building Code* still permitted stairs in dwelling units to have a maximum riser height of 8.25 inches (210 mm) and a minimum tread depth of 9 inches (229 mm); this contrasted with the same Code's requirements for the "7-11"-based standard for other buildings and occupancies.

Role of Stair Step Dimensions. This topic is the most researched aspect of stairway safety and it has a history dating back centuries, indeed, a few millennia (as set out in detail in the proponents 2003 proposal to ICC. This history was described in detail in the proponents proposal in 2003 and will not be repeated here (although, if necessary, it will be part of a comment submitted during 2019 for consideration at the Public Comment Hearing this autumn). Staff can provide the appropriate code change committee with that 2003 proposal if there is a demand from committee members. (It can also be provided to ICC by the proponent if necessary as a PDF file.)

UK Research Findings. Since the turn of the century, about two decades ago, there was extensive stairway safety research in the UK at the Building Research Establishment (BRE), a UK version of US NIST or NRC Canada's former Division of Building Research (up to about 1982). It was briefly noted in the proponent's 2003 and 2010 proposals on the step dimension issue in the IRC. The charts below are based on many charts and other results produced for the BRE's sponsor the national agency in the UK responsible for its building regulations. BRE's research included (1) laboratory studies of ten different stair step run (going or tread depth) dimensions and several different rise dimensions and (2) a mail-back survey of home owners home stair dimensions combined with a survey of falls on their stairs in the preceding two years.

Figure 2 shows one of many results based on both objective measures and test subjects' responses to a multi-item questionnaire used for each combination of experimental stair rise and run.

Figure 2. Results of BRE Laboratory Testing of Combinations of Step Rise and Run/Going, Here Assessed by the Best Subjective Measure

Figure 2 is the chart for the most valuable question or assertion for which the study team wanted to know extent of agreement by individual subjects using a scale for which the lower score is associated with a more-preferred step geometry combination. The results, shown in Figure 2, are for the statement, "I felt safe walking down the stair." There is a streaming video of a discussion between the proponent and one of the two co-investigators, Mike Roys, posted at www.bldguse.com. The discussion, in 2017, focused on the relative importance of the two variables —rise and run—influencing the actual and perceived safety of a stair. While step run (tread depth in the IRC) is very important, there is also some notable effect of the rise. Further research, with larger samples of test subject are needed to pin this down (i.e., statistical significance which was established for the run).

The results of the laboratory studies and the field survey were very similar to what is presented in Figure 3. It shows—for run dimension only— the combined results of the BRE mail-back survey and the laboratory testing; this shows the close correspondence of both subjective and objective measures of the increasing danger of falls when the run dimension is smaller. The vertical scale of the graph in Figure 3 was the basis for estimates, below, on relative risk of falls sufficient to warrant a visit to a hospital Emergency Department in the US.

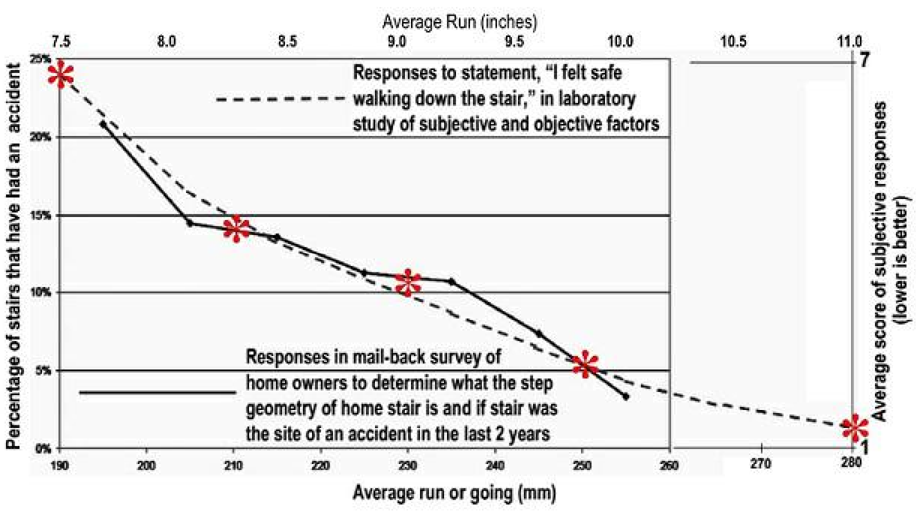


Figure 3. Combined Results of BRE Laboratory Testing of Combinations of Step Rise plus Run/Going and the Results of a Mail-back Survey about Home Stair Dimensions

The proponent, working with original reports of the UK studies as well as numerous meetings with the UK researchers, at BRE and elsewhere, prepared a table which is partly reproduced below, as Table 3, based on a 2013 publication, that described how step run or tread depth ("going" in UK terminology) affected the risk of an injurious fall sufficiently serious to warrant a visit to a hospital Emergency Department. The range of run (tread depth) dimensions in the table ranged from 190 mm (7.5 inches) to 280 mm (11 inches). (These results and the full table partly reproduced as Table 3 are found in: Pauls, J. and Barkow, B., 2013. Combining risks from two leading factors in stair-related falls. *Proceedings* *of the International Conference on Fall Prevention and Protection*, Tokyo, pp. 87-92, Table 2.)

Uniformity condition: Percentage of stairs with TOFF	Annual injurious fall risk rates with various nominal tread runs Risk rates shown are per 100,0000 population				
	190 mm Effective run with carpet	210 mm	230 mm Favoured by US home builders	250 mm Minimum in ICC codes	280 mm Minimum in NFPA codes
0	230	140	110	50	20

Table 3. Small Portion of Published Table: Estimated relative annual risks per 100,000 population, of US hospital emergency department visits for home stair-related falls with various nominal run (going) dimensions and with various occurrences of Top of Flight Flaw (TOFF) non-uniformity

Injury Consequences of Inferior Stairs Resulting from NAHB's Policy and ICC's Refusal to Improve Home Stair Step Dimensions. What these and many other research findings mean today is that, across much of the USA, there is mix of inferior—*indeed dangerously inferior*—stairs in homes in their second decade (or more) of a several-decade life. Such homes with stair step tread depths or runs of only 9 inches (even an inch or more smaller effectively, with carpet coverings) are injuring home occupants at rates exceeding those achievable with "7-11" step dimensions by a factor of as much as six to eight. In standard epidemiological terms such NAHB-demanded, home stairs are associated with—*per 100,000 population*—at least 110 stair-related injuries—*annually*—leading to hospital emergency room (ER) treatment compared with 20 stair-related injuries for stairs meeting the "7-11" standard. (This relationship and the role of dimensions both nominal and with nonuniformities are discussed in detail in the Pauls-Barkow paper, from 2013, cited above in relation to Table 3.)

Injury Costs. As seen in Table 2 (near the front of this substantiation), for the entire US, in 2018, the ER-treated injury toll alone for such NAHB-demanded stairs is estimated to be on the order of 600,000 injuries. Adding other treatment consequences, i.e., doctors offices and clinics along with hospital admissions brings the annual injury toll into the millions in the US with a societal cost on the order of 100 billion dollars or approaching $1,000 per average US household annually. Note that, societal injury costs for such injuries are composed of three components: medical care, work loss and other direct economic losses, plus pain and suffering (quality of life generally) which are, roughly, in the ratio: one : two : seven, respectively. In other words, medical care cost is the smallest of three components responsible for only about 11 percent of total, societal costs. See figure 4.

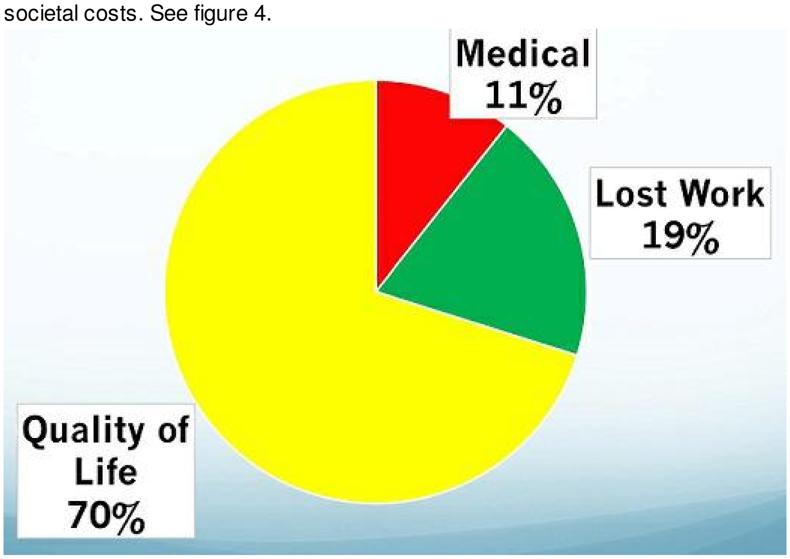


Figure 4. Components of Societal Injury Cost

Benefits of Normal Stairway Use. Moreover, during a year period, there are on the order of one-trillion stair flight uses in the USA, everyone of which has a value to the stair users. Such normal uses have a significant value that must be taken into account in any benefit-cost analysis. This will increasingly be the case as stairs become safer to use—due to design improvements—and thus such uses can be confidently recommended as a good source of exercise our increasingly sedentary populations need for better fitness. Currently, this proponent cannot endorse use of typical US (or Canadian) home stairs for exercise purposes. Exposure to predictable and preventable dangers has to be minimized and this means that a valuable, readily available place to exercise has less value over its lifetime, simply because its design and construction have been dictated largely by two organizations in the USA: NAHB and SMA, using a flawed code-development process maintained (in an otherwise laudable process for example for its openness and use of communication media) by the ICC.

Concluding Remarks

There are two tactics currently being utilized to change the IRC requirements, one uses 'micro-surgery' to change the smallest amount of text in IRC Section on Stairways, focused only on the step dimension issue in relation to specifying minimum tread depth (run) and maximum rise. This would change minimum tread depth from 10 inches to 11 inches and would change maximum rise from 7.75 inches to 7 inches. The other tactic takes a more-comprehensive approach, substituting almost all IRC's requirements for stairways through a mandatory reference to NFPA 101's requirements on home stairways, specifically for one- and two-family dwellings—the same scope as the IRC has.

In the proponent’s professional opinion, the first tactic addresses a problem largely created and maintained by the NAHB; the other adds issues for which the SMA is largely responsible due to its largely poorly justified tinkering with a wider range of stairway design issues which owe more to tradition than to technology. SMA’s approach has been marked by the attempt to keep building what has been built in the past, without adequate scientific and technical justification. It appears that SMA has faired very poorly in attempting to do this in the NFPA process where scientific and technical justification carries more weight.

In the proponent’s professional opinion, both the NAHB and SMA bear much responsibility for the sorry state of home stairway safety in facilities built to the IRC. Ultimately it is ICC that has failed, and—unless drastic actions are taken—will continue to fail us with huge injury ramifications that will last for many decades. This raises questions about the Preface to the IRC which states: (ICC) “provides an international forum for discussion and deliberation about building design, construction methods, safety, performance requirements, technological advances and innovative products.” If this were completely true, why do the requirements of the IRC differ so significantly from those adopted by NFPA?

With the “7-11” being, now, a long-established standard for stairway safety—including in the *International Building Code* for all settings except one- and two-family dwellings, why is the “7-11” not applied to the setting where it is most needed and where it would produce the largest benefit for the cost of implementation—***in homes?***

Bibliography: All citations to the published literaure are embedded in the Reason Statement

Cost Impact: The code change proposal will increase the cost of construction
While cost of construction will increase, that increase (as shown also in the first proposal on this same topic in a 2003 proposal on stairways in teh IRC) pales in comparison to the benefits of the "7-11" step geometry for dwelling unit stairs. (From the Reason Statement comes the following updated detail on cost impact.

"If we assume, as an approximation, there were about 120 million US households in 2012 (the midpoint in the periods discussed above) and further assume an average of one flight of stairs for each household (with some homes having several flights of stairs and many having none), the average cost of home stairway-related injuries is roughly $700 per stair flight (or household) *per year*. This average injury cost greatly exceeds the annual cost (e.g., over a 50-year service life) of a stair flight in a home. As currently allowed by the IRC and built into new homes, stairways with such high annual injury costs are an extremely poor investment in terms of costs to society, families and individuals."

Moreover, for all the other changes proposed for Section 311.7, there is actually a reduction of cost for handrails for example as the more functional handrails are also less costly than the ones typically provided for new home stairways. Changes such as lighting of stairways also have a minor impact on costs as, with modern lighting control systems and energy-saving sources, lighting with increased illumination levels that operates as needed, automatically, means this is not costly as in the past.

Staff Analysis: The referenced standard, NFPA 101-18, is currently referenced in other 2018 I-codes.

RB116-19

Public Hearing Results

Errata: This proposal includes the following errata
Editorial revision as follows: If the final action on this proposal is Approved as Submitted, or Approved as Modified, The NFPA 101 standard will be added to Chapter 44.

Committee Action: **Disapproved**

Committee Reason: This would require that NFPA 101 be bought for every inspector. The IRC is intended to be a standalone code and this defeats the purpose. We need a work group to gather empirical data on this issue. (Vote: 10-0)

Assembly Action: **None**

RB116-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R311.7

Proponents:
Jake Pauls, representing self (bldguse@aol.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

<u>**R311.7** **Stairways.** Stairways shall comply with Sections R311.7.1 through R311.7.12.2 or the stairway requirements of NFPA 101 for one- and two-family dwellings.</u>

Commenter's Reason: The ICC IRC-B Committee provided only three reasons for disapproving RB116-19.

I concede that all three reasons have validity but only the third is responsive to the development of a path forward. Such a path—*and its utilization as soon as possible*—appears to me to be the only acceptable solution to the problem of a very flawed section of the IRC.

My main purpose in submitting this comment is, as was noted in my testimony at Albuquerque, to get this problem understood by—and addressed by ICC voting members. When they see the extent of the problems with the IRC stairways section, they will—*I hope*—press the ICC leadership to begin seriously to address the underlying problems. One is the excessive power given (in the late 1990s) to the home building industry in setting standards for minimum safety of one and two-family dwellings. As a member of ICC's Industry Advisory Committee (representing, as I do to this day, the American Public Health Association, APHA) I objected strenuously when the voting power on the IRC committees was given to the NAHB. In my professional opinion, that was a dreadful error on the part of the ICC Board. My opinion was later backed by formally adopted public policy positions by APHA (still in effect today).

In the meantime, NFPA maintained a progressive position with regard to design of one and two-family dwellings, notably on the issue of stairway usability and safety. This was reflected in its 2003 and subsequent editions of NFPA 101 and NFPA 5000. Meanwhile, much of what ICC was producing not only failed to adequately respond to the need for improved requirements for stairways and, even worse, some requirements were made even worse because proposed changes were not based on the best available evidence on usability and safety (as developed by professionals in public health and ergonomics for example).

There were other process issues that ICC lost sight of relative to what its predecessor organization, CABO, had been doing with its Board for the Coordination of the Model Codes (BCMC). Especially notable were BCMC's 1985 Report on Means of Egress and its 1993 report mainstreaming several key stairway safety requirements from their original scoping only for public buildings to include one and two-family dwellings. The recommended mainstreaming of the "7-11" step dimension rule as well as research-based handrail graspability (as well as general scoping) requirements are especially important here.

The time is now right for the ICC Board to recognize that, despite many successes in ICC, there is a growing concern about stairways—*and the expanding needs of their users*—to be treated with greater respect for evidence-based design standards addressing very serious ergonomic and public health shortcomings. Here we are talking about over one-hundred billion dollars annually for stair related injuries—*90 percent in homes*—in the USA alone. We need another BCMC-type effort that brings multiple code groups and perspectives to the discussion table.

I have tried, over the years to get the ICC Board to be responsive on these matters without success. It this continues, more desperate measures will have to be resorted to, including (potentially) having ICC named as a third-party defendant in legal actions seeking compensation for predicable and preventable injuries, especially in homes. To borrow from Shakespeare, "let's skill the lawyers."

I work closely with lawyers in my international professional practice. The ergonomic and public health evidence I bring to this professional activity has resulted, over about two recent years, to my being conferred with an Honorary Doctor of Science degree from a University known worldwide for its cutting-edge work on movement of people in built environments. Last October another university, in the US, conferred the first new award named in my honor, the Jake Pauls Award for Advocacy in Building and Fire Safety.

It is now time to have ICC join others in addressing the serious problems of home safety. Stairways (and bathtub and shower safety) are problems I am addressing (advocating on behalf of consumers) currently. I would very much like to have ICC join the effort and become part of the solution rather than being part of the problem.

Finally, I would welcome any ICC chapter approaching me (at bldguse@aol.com) with a request to provide a custom presentation of a no-charge, half-day workshop to its members on not just the stairway safety issue but that of bathtub and shower safety (as addressed In my IRC proposal IRC81-19 and a public comment). Preferably that could be done prior to the Public Comment Hearings in Las Vegas but, if only possible later, that would be helpful in Chapter demonstration of real concern about these leading home-related injury topics that must be better addressed in ICC codes as well as in code enforcement procedures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
See information in original RB116-19.

Public Comment# 2133

RB119-19

IRC®: R312.1.2, R312.1.3

Proposed Change as Submitted

Proponents: Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov); Gary Traver, representing NYS Department of State (gary.traver@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R312.1.2 Height. ~~Required~~ Where installed, *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) in height as measured vertically above the adjacent walking surface or the line connecting the *nosings*.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the *nosings*.
2. Where the top of the *guard* serves as a handrail on the open sides of stairs, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the *nosings*.

R312.1.3 Opening limitations. ~~Required~~ Where installed, *guards* shall not have openings from the walking surface to the required *guard* height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open side of stairs shall not have openings that allow passage of a sphere $4^3/_8$ inches (111 mm) in diameter.

Reason: The way the language is currently written, only required guards need to meet the height and opening limitations. Meaning guards on a low (30 inches or less above grade) deck, installed voluntarily as a design choice, are permitted to be lower than 36-inches and with openings which would allow small children to get caught in. Just like many other code provisions, if a component is installed, whether it is required or not, it should meet the safety requirements of the code instead of providing a false sense of security.

Cost Impact: The code change proposal will increase the cost of construction
This change will likely marginally increase the cost of construction for those elevated walking surfaces that are 30 inches or less that voluntarily choose to install guards.

RB119-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There was no data or research provided to indicate that guards are needed at all drop offs. This proposal creates problems from an enforcement standpoint. (Vote: 11-0)

Assembly Action: **None**

RB119-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R312.1.2, R312.1.3

Proponents:
Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R312.1.2 Height. Required ~~Where installed,~~ *guards* at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) in height as measured vertically above the adjacent walking surface or the line connecting the *nosings*.

Exceptions:

1. *Guards* on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the *nosings*.
2. Where the top of the *guard* serves as a handrail on the open sides of stairs, the top of the *guard* shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the *nosings*.

R312.1.3 Opening limitations. Where installed, *guards* shall not have openings from the walking surface to the required *guard* height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a *guard*, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. *Guards* on the open side of stairs shall not have openings that allow passage of a sphere $4^{3}/_{8}$ inches (111 mm) in diameter.

Commenter's Reason: RB119-19 should be Approved as Modified by This Public Comment.
The original proposal reason focused on addressing non-required guards being installed in an unsafe or insufficient manner. The opposition to the proposal centered around a reluctance to modify the height requirement of Section R312.1.2 by replacing the word "Required" with "Where installed." After discussing the issue further, there is valid concern of what constitutes a "guard" and the potential for misinterpretation.

Therefore Section R312.1.2 should remain unchanged from the 2018 IRC language.

However, there was general agreement that entrapment and strangulation were valid concerns. Therefore, this public comment proposes that the original proposal be revised to only change Section R312.1.3. A child being entrapped in an opening is a valid concern at any height. While a child may not be strangled at a height of less than 30 inches, the potential for other injuries is still present. The 2018 IRC Commentary states: *"Guards must be constructed so that they prohibit smaller occupants, such as children, from falling through them."* (Page 3-116) If a guard is installed, the guard should not become a hazard and should still prohibit smaller occupants from falling through.

Bibliography: *2018 IRC Code and Commentary—Volume 1*. First Printing, Vol. 1 of 2, International Code Council, 2018.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This change will likely marginally increase the cost of construction by requiring more material and labor to construct guards meeting the opening limitations. This will not require any new guards in places the code currently does not require them.

Public Comment# 1550

Public Comment 2:

Proponents:
Thomas Zuzik Jr, of Railingcodes.com Representing NOMMA - The National Ornamental & Miscellaneous Metals Association, representing NOMMA - The National Ornamental and Miscellanuous Metals Association (coderep@railingcodes.com)

requests Disapprove

Commenter's Reason: The submitting proponents of RB119-19 have not provided any data or new research in their reason statement's

justification.
The charging statements “Where required” were re-affirmed as the correct requirement during the International Code Council’s(ICC) - Code Technology Committee’s (CTC) review and area of study regarding climbable guards from April 2005 through the publication of their final report in May 2008.
The CTC not only looked at climb-ability while doing the area of study, but also reviewed the height and opening limitations and when and where the requirements are needed. The final report cites the charging statement “Where required” in the multiple code change proposals submitted by the CTC during their review and the passing of the changes and recommendations brought forth by the committee through the ICC model code change process.
Additionally, when generalizing restrictions on non-required guards, how is one to interpret the installation of patio sidewalk separation for cafés and restaurants. Are these guards at ground level? When is something resembling a guard, now considered a guard?
The original proponents code change would drastically decrease the number of lower locations where non-required type “guards” live and are commonly being installed along low openings and at lower heights as architectural accents and providing a level of safety, compared to nothing being installed providing no safety at all.
During the CTC’s area of study, the committee reviewed adding the charging statement of “where required” to the structural section also. From our interpretation of their review while attending the meetings, the CTC committee decided to leave that charging statement out of the structural section. The reason noted was the vast majority of people could see or feel the height of a non-required guard or the openings within a non-required guard, but they would not be able to determine if the non-required guard was structurally sound. Therefore, non-required guards are still subject to the structural requirements set forth within the current code, when deemed a non-required guard and not another type of architectural accent, per say fence.
Additionally, the proponent's direction will blur the line between free standing handrails and guards, for in the residential handrail and guard industry though the two items are not the same, a large majority of the time they are combined on stairs and ramps. In situations where only a handrail is required the result is that simple handrails will be scrutinized as guards, whether a guard is required or not.
Example: A (3) strand horizontal pipe handrail mounted on a 16-inch vertical rise ramp to a front porch at the beach. Applying this code change would now require this open air style handrail to have guard infill meeting the 4" sphere, simply because it looks like a guard and is at a low lying edge.
We have included in this request for disapproval pictures of an installed handrail and an architectural feature better known as a non-required guard. Both of which would no longer be compliant under the proponent's code change. (AIWNOMMA-01.jpg) & (AIWNOMMA-02.jpg).

The results of RB119-19 passing would end up requiring guards everywhere something similar was installed, and if the proponents intent is to have more guards installed a better solution would be lowering the current height trigger point from 30 inches for when guards are required.

Bibliography: 1. International Code Councils - Code Technology Committee
CTC Committe working documents, meeting minutes and reports
https://www.iccsafe.org/products-and-services/i-codes/code-development-process/ctc-area-of-study-climbable-guards/

2. International Code Councils - Code Technology Committee
Area of Study Climbable Guards final report May 21st, 2008
https://www.iccsafe.org/wp-content/uploads/ctc/Final_Report_May_2008.pdf

3. Pictures supplied by NOMMA Membership

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# 1623

RB125-19

IRC®: SECTION R314, R314.1, R314.1.1, R314.2, R314.2.1, R314.2.2, R314.2.3 (New), R314.3, R314.3.1, R314.4, R314.4.1 (New), R314.5, R314.6, R314.7, R314.7.1, R314.7.2, R314.7.3, R314.7.4

Proposed Change as Submitted

Proponents: Francis McAndrew, NYS Department of State, representing NYS Department of State (francis.mcandrew@dos.ny.gov); Ronald Stark, NYS Department of State, representing NYS Department of State (ronald.stark@dos.ny.gov)

2018 International Residential Code

Revise as follows:

SECTION R314
SMOKE ALARMS AND HEAT DETECTION

R314.1 General. Smoke alarms, heat detectors, and heat alarms shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be *listed* in accordance with UL 217. Heat detectors and heat alarms shall be listed for the intended application. Combination smoke and carbon monoxide alarms shall be *listed* in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms, heat detectors, and heat alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in *dwelling units*. A heat detector or heat alarm shall be provided in new attached garages.

R314.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a permit occur, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, the *addition* or replacement of windows or doors, or the addition of a porch or deck.
2. Installation, alteration or repairs of plumbing or mechanical systems.

Add new text as follows:

R314.2.3 New attached garages. A heat detector or heat alarm rated for the ambient outdoor temperatures and humidity shall be installed in new garages that are attached to or located under new and existing dwellings. Heat detectors and heat alarms shall be installed in a central location and in accordance with the manufacturer's instructions.

Exception: Heat detectors and heat alarms shall not be required in dwellings without commercial power.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional *story* of the *dwelling*, including *basements* and *habitable attics* and not including crawl spaces and uninhabitable *attics*. In *dwellings* or *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full *story* below the upper level.
4. Smoke alarms shall be installed not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by this section.

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.

Revise as follows:

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual *dwelling unit*. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

> **Exception:** Smoke alarms and alarms installed to satisfy Section R314.4.1 shall not be required to be interconnected to existing smoke alarms where such existing smoke alarms are not interconnected or where such new smoke alarm or alarm is not capable of being interconnected to the existing smoke alarms.

Add new text as follows:

R314.4.1 Heat detection interconnection. Heat detectors and heat alarms shall be connected to an alarm or a smoke alarm that is installed in the dwelling. Alarms and smoke alarms that are installed for this purpose shall be located in a hallway, room, or other location that will provide occupant notification.

R314.5 Combination alarms. Combination smoke and carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms.

Revise as follows:

R314.6 Power source. Smoke alarms, alarms, and heat detectors shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning *equipment* provisions of NFPA 72. Smoke detectors shall be *listed* in accordance with UL 268.

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner.

R314.7.4 Combination detectors. Combination smoke and carbon monoxide detectors shall be permitted to be installed in fire alarm systems in lieu of smoke detectors, provided that they are *listed* in accordance with UL 268 and UL 2075.

Reason: An estimated 9,000 residential garage fires are reported to United States fire departments each year and cause an estimated 50 deaths, 400 injuries, and $557 million in property loss (NFPA Research Report: Home Structure Fires, September 2017).
Fires that originate in residential garages are normally larger, spread farther, and cause more damage than fires that start in other areas of a home. This is largely due to garages not having any means of smoke or heat detection. By the time a smoke detector in the dwelling detects the fire, or the home owner or a neighbor notices the fire, it is often too late, and the fire has begun to burn through the fire separation between the garage and the dwelling. At this point, the fire rapidly spreads through wall cavities and begins to attack the structural parts of the home. Unfortunately, smoke alarms installed in garages may lead to nuisance alarms due to vehicle exhause fumes.

Installing a heat detector or heat alarm in these unprotected areas of a home will significantly reduce fire related deaths, injuries, and property loss.

Bibliography:

1. NFPA Research Report: Home Structure Fires, September 2017. https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Building-and-life-safety/osHomes.pdf
2. FEMA Topical Fire Report Series: Residential Building Garage Fires (2009-2011). https://www.usfa.fema.gov/downloads/pdf/statistics/v14i12.pdf
3. USFA Prevent Home Garage Fires. https://www.usfa.fema.gov/downloads/pdf/publications/prevent_home_garage_fires_flyer.pdf

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

- An interconnected heat detector or heat alarm will increase the cost of construction by about $100, which includes installation.
- If a new garage is attached to an existing dwelling that has only battery powered smoke alarms installed, the heat detector or heat alarm will require the installation of an interconnected alarm or smoke alarm to be installed in the dwelling for the purposes of providing occupant notification. Under this scenario, the total cost will increase to about $200.

RB125-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is already effective prescriptive fire protection for this in the code. There are several problems with the proposed text. Instead of referring to temperature and humidity, why not just refer to outdoor use? Regarding the construction section, there is no need to use the term "new" as that is the intent of the section. (Vote: 11-0)

Assembly Action: **None**

RB125-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R314.1, R314.1.1, R314.2, R314.2.1, R314.2.3 (New), R314.4.1 (New), R314.6

Proponents:

Francis McAndrew, New York State Department of State Division of Building Standards and Codes, representing New York State Department of State Division of Building Standards and Codes (francis.mcandrew@dos.ny.gov); China Clarke, representing New York State Department of State Division of Building Standards and Codes (china.clarke@dos.ny.gov); Kevin Duerr-Clark, representing NYS Department of State (kevin.duerr-clark@dos.ny.gov)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R314.1 General. Smoke alarms and heat detection shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be *listed* in accordance with UL 217. Heat detection shall be *listed* in accordance with UL 521 or UL 539, as appropriate for the intended application. Combination smoke and carbon monoxide alarms shall be *listed* in accordance with UL 217 and UL 2034.

R314.2 Where required. Smoke alarms and heat detection shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in *dwelling units*. Heat detection shall be provided in new attached garages.

R314.2.3 Attached garages. Heat detection rated for the ambient outdoor temperatures shall be installed in new garages that are attached to or located under new and existing dwellings. Heat detection shall be installed in a central location and in accordance with the manufacturer's instructions.

Exception: Heat detection shall not be required in dwellings without commercial power.

R314.4.1 Heat detection interconnection. Heat detection devices shall be connected to an alarm or a smoke alarm that is installed in the dwelling. Alarms and smoke alarms that are installed for this purpose shall be located in a hallway, room, or other location that will provide occupant notification.

R314.6 Power source. Smoke alarms and heat detection devices shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.

Commenter's Reason: The original code change proposal contained fire data from NFPA's Home Structure Fires research report. A commenter questioned this data, stating that it should be taken with a grain of salt. The individual stated that the data relates to all existing homes and that the data does not reflect the age of the home. This comment is irrelevant because fire does not discriminate. New garages do not contain any less combustible material than they did in the past. In fact, they may contain more, such as volatile lithium-ion batteries and energy storage systems.

A comment was made which stated that older homes don't have sheetrock separation between the home and the attached garage. This is not true. There are many older homes that do have sheet rock separation. More importantly, this argument is also irrelevant. What must be understood is that fire separation between an attached garage and a dwelling only allows the fire to burn for a longer period of time before it is detected. During this period, the fire grows larger, hotter, and more difficult to control. This is the reason that garage fires cause greater damage. The way that garage fires are detected may be summed up in one of three ways:

1. A neighbor or passerby notices the fire,
2. The fire burns through the garage/dwelling separation and ignites the home, or
3. The homeowner detects the fire (audible, heat, and/or smoke).

Unfortunately, homeowners do not always detect the fire, especially when they are asleep. Placing a heat detector in this unprotected area of a home will provide a level of protection that does not currently exist. Fire separation between a dwelling and an attached garage may only provide a false sense of security. Even FEMA recommends the installation of a heat detector to "*aid in the early detection of garage fires*".

https://www.usfa.fema.gov/downloads/pdf/statistics/v14i12.pdf

A comment was made stating that manufactures don't have devices that are listed for high temperatures and further stated that the backup batteries are only listed for up to 130° F. There are many devices that are rated for high temperatures because these devices are intended to be installed in areas where fire occurs. For example, First Alert, System Sensor, and Kiddie manufacture devices that will meet the needs of this proposal.

There are many different models of heat detectors to choose from. More importantly, there are many different ways to integrate a heat detector into a smoke detection system, a smoke alarm, or notification appliance. The code change proposal addresses this diversity by stating "*Heat detection shall be listed to UL 521 or UL 539, as appropriate for the intended application."*

A committee member stated that "*There are several problems with the proposed text. Instead of referring to temperature and humidity, why not just refer to outdoor use*?" This recommendation does not work because the devices are not rated for outdoor use. The devices are rated for indoor use and for temperatures that approach ambient outdoor temperatures.

A committee member stated that "*There is already effective prescriptive fire protection for this in the code*". There is not effective prescriptive fire protection for garage fires in the code, which is the sole reason for this proposal. The difference between fire separation and fire detection in this case is that separation allows the garage and its contents to burn for a predetermined period of time before allowing the fire to spread to the attached home. In contrast, a heat detector will provide occupant notification before the fire spreads to the home. This code change proposal is intended to address a well-documented hazard that is not adequately addressed by the code.

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

- For a new home with a new attached garage, an interconnected heat detection device will increase the cost of construction by about $100, which includes installation.
- If a new garage is attached to an existing dwelling which only has battery powered smoke alarms installed, the heat detection device will require the installation of an interconnected alarm or smoke alarm to be installed in the dwelling for the purposes of providing occupant notification. Under this scenario, the total cost will increase to about $200.

Public Comment# 1999

RB129-19

IRC®: R314.3.1 (New)

Proposed Change as Submitted

Proponents: Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

2018 International Residential Code

Revise as follows:

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Smoke alarms listed and marked “helps reduce cooking nuisance alarms” shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking appliance.

Reason: This proposal recognizes that smoke alarms listed to the new edition of UL 217 (with an effective date of May 29, 2020) are required to pass tests designed to reduce nuisance alarms caused by residential cooking. The proposal provides an additional option for the types of smoke alarms that can be used near cooking appliances, without changing additional options.
The wording is based on the following 2019 NFPA 72 language:

29.11.3.4 (6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 ft (1.8 m) and 20 ft (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking.

There is no need to reference the 2022 effective date in NFPA 72 because if smoke alarms are listed to the new requirements prior to that date they should be allowed to be used as an option to the other technologies provided in Items 1 to 3.

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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommittee-bcac.

Cost Impact: The code change proposal will increase the cost of construction
The increased cost will be for providing carbon monoxide detection when classrooms in Group E occupancies are covered by these code sections.

RB129-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This proposal is consistent with UL 217, 8th edition, which requires that these alarms be identified as cooking nuisance resistant. (Vote: 10-1)

Assembly Action: **None**

RB129-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R314.3.1 (New)

Proponents:
Micah Chappell, representing Seattle Department of Construction and Inspections (micah.chappell@seattle.gov); Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R314.3.1 Installation near cooking appliances. Smoke alarms shall not be installed in the following locations unless this would prevent placement of a smoke alarm in a location required by Section R314.3.

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking *appliance*.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking *appliance*.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking *appliance*.
4. Smoke alarms listed~~ and marked "helps reduce cooking nuisance alarms"~~ <u>in accordance with NFPA 72 for resistance to common nuisance sources</u> shall not be installed less than 6 feet (1828 mm) horizontally from a permanently installed cooking appliance.

Commenter's Reason:
There is no requirement in NFPA 72 for smoke alarm devices to be **marked** "helps reduce cooking nuisance alarms". The devices are only required to be **listed** for resistance to common nuisance sources from cooking:

> *NFPA 72 29.11.3.4 (6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 ft (1.8 m) and 20 ft (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be **listed** for resistance to common nuisance sources from cooking.*

This PC addresses what is actually required by NFPA 72 by removing the unneeded requirement for manufacturers to mark the devices.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The PC decreases the cost of the proposed code change. Removing the requirement for smoke alarms to be marked with the nuisance alarm language found in NFPA 72 decreases the cost of the original code change proposal to manufacturers.

Public Comment# 1418

RB131-19

IRC®: R316.2.1 (New), R316.3

Proposed Change as Submitted

Proponents: David Rich, Reax Engineering, representing Reax Engineering Inc. (rich@reaxengineering.com); Joe Charbonnet, representing Green Science Policy Institute (joe@greensciencepolicy.org); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); Arlene Blum, representing Green Science Policy Institute (arleneb@lmi.net); Donald Lucas, representing Self (dlucas0929@gmail.com); Suzanne Drake, representing PERKINS+WILL (suzanne.drake@perkinswill.com); Marjorie Smith, representing Siegel & Strain Architects (msmith@siegelstrain.com); Paul Wermer, representing self (paul@pw-sc.com); Michael Lipsett, representing Self (mlipsett@astound.net); Alicia Daniels Uhlig, representing International Living Future Institute (alicia.uhlig@living-future.org); William Kelley, County of Marin, representing County of Marin and County Building Officials Association of California (CBOAC); Tony Stefani, representing San Francisco Firefighters Cancer Prevention Foundation (stefanit@sbcglobal.net); Clark Rendall, representing Troon Pacific (cpr@troonpacific.com); Vytenis Babrauskas, representing Fire Science and Technology Inc. (vytob@doctorfire.com); Joseph Fleming, Boston Fire Dept., representing Boston Fire Dept.; Teresa McGrath, representing Healthy Building Network (tmcgrath@healthybuilding.net); Alison Mears, Parsons The New School, representing Healthy Materials Lab (mearsa@newschool.edu); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Residential Code

Add new text as follows:

R316.2.1 Mark on polystyrene foam insulation without flame retardants. Polystyrene foam insulation boards manufactured without flame retardants shall be marked in accordance with this section.

1. Each board shall be marked on both faces every 8 square feet in red 1/2" text with the following information:
- WARNING - FIRE HAZARD
- This product must only be installed below a minimum 3.5-inch thick concrete slab on grade.
- NOT FOR VERTICAL OR ABOVE GRADE APPLICATIONS
- This product contains NO flame retardants
- Not tested for flame spread or smoke development requirements of the model building codes

2. Each package shall be marked on at least two sides in red 1/2" text with the following information:
- WARNING – COMBUSTIBLE MATERIAL
- Keep away from ignition sources
- Maintain code required separation between product storage and structures under construction (minimum 30 feet).

Revise as follows:

R316.3 Surface burning characteristics. Unless otherwise allowed in Section R316.5, foam plastic, or foam plastic cores used as a component in manufactured assemblies, used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness and density intended for use in accordance with ASTM E84 or UL 723. Loose-fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

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

1. Foam plastic insulation more than 4 inches (102 mm) thick shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested at a thickness of not more than 4 inches (102 mm), provided that the end use is *approved* in accordance with Section R316.6 using the thickness and density intended for use.

2. Polystyrene foam insulation boards with a maximum thickness of 2 inches (51 mm) where installed below a minimum 3.5-inch (89 mm) thick concrete slab-on-grade.

Reason: Purpose of Proposal
Polystyrene insulation (EPS and XPS) iis commonly used in buildings to improve energy efficiency. To meet fire test building code requirements in the US and Canada all such insulation currently must contain flame retardant chemicals. In many cases, the tests do not accurately assess the fire safety of insulation.[1] Research has shown that flame retardants used in polystyrene insulation below a slab-on-grade do not provide a significant fire-safety benefit. However, across their lifecycle these chemicals can harm human and ecosystem health.[2]

This code change proposal would allow, but not require, the use of polystyrene insulation without flame retardants when installed below a concrete slab-on-grade at least 3-1/2 inches thick. The proposal was developed in response to the demand for healthier building materials from designers, developers and builders.

This proposed code change is nearly identical to the code change developed and advanced by the California Office of the State Fire Marshal for both the California Residential and the California Building Codes.

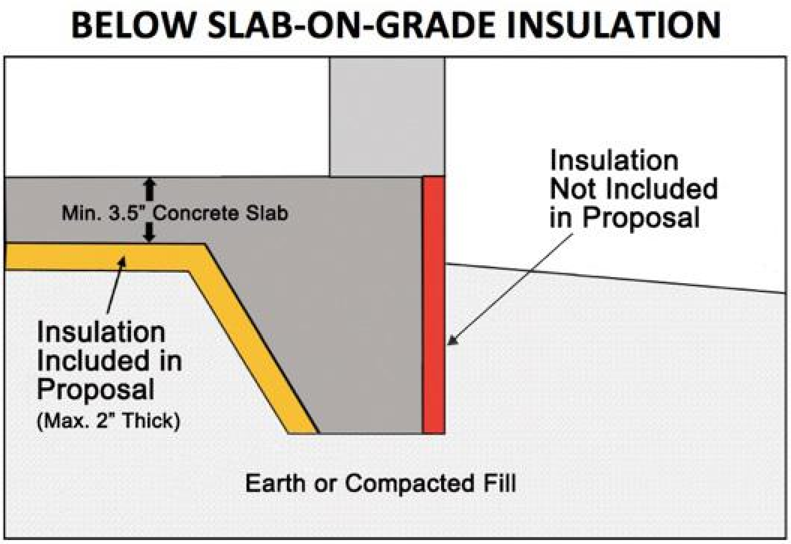


Figure 1. Typical application where the proposed code change would apply.

Justification for Proposal

Academic research and expert opinion that flame retardants are unnecessary for insulation below a slab- on-grade.[1,3] Neither an ignition source nor sufficient oxygen are present below a concrete slab-on-grade to support combustion. This proposal stipulates that flame retardant-free insulation and packaging be labeled with red 1⁄2” text lettering to ensure safe transport, storage, and proper installation.

Flammable liquids and gases, engineered wood products, and ABS pipe are all commonplace on construction sites. Other flame retardant-free polystyrene products such as cups and plates, packaging, and ice chests are stored and transported safely. Existing fire safety requirements in the fire and building codes, and in transportation regulations, adequately address necessary design and safety precautions for flame retardant-free polystyrene insulation.

Through the process described below, the California Office of the State Fire Marshal determined that chemical flame retardants provide no fire safety benefit for polystyrene insulation below a concrete slab-on-grade.

On the other hand, considerable peer-reviewed research has found that flame retardants used in building insulation are harmful to human and ecosystem health.[4,5] Flame retardants have been linked to neurological impairment, hormone disruption, and aquatic toxicity.[6–8] The flame retardant currently used in polystyrene insulation, PolyFR, is a brominated chemical that has not been well-studied nor proven safe.[4,9] The manufacture, installation, demolition, landfilling, incineration, and recycling of flame-retarded polystyrene insulation can lead to environmental release of flame retardants and their toxic combustion by-products including brominated dioxins and furans. These chemicals can harm the health of construction workers and others exposed throughout the product life-cycle.

Human and ecosystem health and safety are within the ICC's scope of concern. The language of intent of the 2018 IRC in Section R102.3 states: “The purpose of this code is...to safeguard the public safety, health and general welfare...from...hazards attributed to the built environment.”[10] Action has been taken in ICC codes to limit exposure to lead, carbon monoxide, ozone depleting substances, volatile organic compounds, toxic compounds, and formaldehyde based on scientific evidence demonstrating that these materials present human health and environmental hazards.[10–13]

History of Proposal Development

The California Office of the State Fire Marshal developed the language in this IRC proposal in collaboration with a large, multi-stakeholder Working Group on flammability standards for building insulation materials from 2014-2016. The Working Group recommended testing to determine the fire safety benefit of adding flame retardants to polystyrene insulation below a slab-on-grade.[14]

The Office of the State Fire Marshal commissioned Oklahoma State University (OSU) to compare the flammability of polystyrene insulation in a subgrade installation with and without flame retardants. The CAL Fire/OSU Phase II Working Group reviewed and provided input on the testing criteria and results. Members of the Working Group representing multiple stakeholder perspectives were present for the testing. This group included scientists, NGOs, and representatives of flame-retardant manufacturers. Standard testing protocols had not been previously developed for combustible materials below a concrete slab-on-grade due to a lack of fire hazard in this application. Therefore, the Working Group, in collaboration with the OSU researchers, developed the specific tests and testing configurations.

The OSU researchers found:[15]

- When installed below-slab, insulation without flame retardants presents no risk of fire spread to the building and will not endanger occupants or first responders.
- Adding flame retardants to polystyrene insulation does not significantly reduce peak heat release rates.
- The time to ignition of flame-retardant free polystyrene was comparable to other combustible materials commonly found at construction sites.

The Phase II report can be found at: http://osfm.fire.ca.gov/codedevelopment/pdf/CalFire- OSU_Phase_II_Working_Group_Final_Report.pdf

Based on the result of the independent testing and following review by the California Building Standards Commission's Code Advisory Committee and public comment, the Office of the State Fire Marshal proposed code changes to the California Building Standards Commission which are technically identical to this proposal for the IRC.

In summary, the California Office of the State Fire Marshal concluded, based on extensive stakeholder input, prior research, and transparent and independent testing by OSU, that flame retardant-free polystyrene foam insulation below slab-on-grade presents no fire risk, and the addition of flame retardants provides no fire-safety benefit. Flame retardant-free polystyrene insulation boards would create no more of a fire hazard than other combustible materials commonly found on construction sites, existing codes and standards that cover fire safety during construction.

Precedent in Scandinavian countries

Code updates in Norway have allowed polystyrene insulation board without flame retardants in buildings. A report by the Norwegian government in 2011 stated insulation placed underneath the concrete slab is considered to be the most fire safe solution. In the finished foundation, the insulation material is well protected from fire exposure. There is no advantage of using fire resistant materials or materials with flame retardants in this construction."

Similarly, a Risk Management Evaluation for EPS and XPS foam insulation stated: "By using thermal barriers it is possible to fulfill fire safety requirements in most uses in construction and buildings with EPS and XPS without a fire retardant do not represent a higher cost to the manufacturer. Our research of available data from these countries found no evidence of increased fire risk, insulation fires, or rollbacks of these code changes.[18,19] Thus, this proposed code change has a significant precedent without increased fire risk.

Summary Statement

The proponents urge you to support this common-sense proposal. Human and ecosystem health will be improved. Fire fighters, building officials, and architects agree that builders should be able to choose flame retardant-free polystyrene insulation below a slab-on-grade.

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Cost Impact: The code change proposal will not increase or decrease the cost of construction
Because this code change is not mandatory, there would be no required increased or decreased costs.

RB131-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: In Section R316.2.1, now building inspectors will have to check labels on site, which will add to their workload. There is a challenge with combustible items in general. NFPA 241 is not in the residential code.
R316.3 does not seem to be a problem. Insulation under 3 1/2 inches of concrete shouldn't be a problem.

There is some redundant language in the warning label. Saying it must be installed below 3 1/2 inches of concrete only, and then not for vertical applications, is redundant. The 30 foot requirement comes from NFPA 241, but that is not referenced in the IRC. "Model building code" is written on the test label. Which model building code? Be specific and say IRC if that's what you mean. The labeling is getting there but is not there yet.

It appears that foam might be able to be used under the slab under the current code text.

Some labeling criteria is not relevant for the building inspector. The toxicity and chemical issues are outside the scope of the IRC. OSHA, EPA and the federal government might be the appropriate agencies to deal with that. The labeling language is flawed. The building officials are not the right agents to enforce this. The labeling hampers what this proposal is trying to accomplish. This is a real issue. There needs to be collaboration with industry to find a way to address this issue. We are loosing firefighters. We need to pull together firefighters, academia, research, manufacturers and suppliers. But this argument shouldn't be happening in the code arena. It should be happening in the research area. To many of our friends are dying.

(Vote: 10-1)

Assembly Action: **None**

RB131-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R316.2.1 (New)

Proponents:
David Rich, Reax Engineering, representing Reax Engineering Inc. (rich@reaxengineering.com); Joe Charbonnet, representing Green Science Policy Institute (joe@greensciencepolicy.org); Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Donald Lucas, representing Self (dlucas0929@gmail.com); Suzanne Drake, representing WRNS Studio (sdrake@wrnsstudio.com); Ron Flax, Boulder County, representing Self (rflax@bouldercounty.org); David Collins, representing The Preview Group, Inc. (dcollins@preview-group.com); Steven Winkel, representing American Institute of Architects (swinkel@preview-group.com); William Kelley, Marin County Community Development Agency, representing Marin County Community Development Agency (bkelley@marincounty.org); Racquel Segall, representing International Association of Fire Fighters (rsegall@iaff.org); Tony Stefani, representing San Francisco Firefighters

Cancer Prevention Foundation (stefanit@sbcglobal.net); Glenn Schainblatt, representing County Building Officials Association of California (gschainblatt@cityofsebastopol.org); Katie Almand, CALBO, representing CALBO (kalmand@calbo.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R316.2.1 Mark on polystyrene foam insulation ~~without flame retardants.~~ not meeting R316.3 Surface burning characteristics. Polystyrene foam insulation boards ~~manufactured without flame retardants~~ not meeting the surface burning characteristics requirements in Section R316.3 shall be marked in accordance with this section.

1. Each board shall be marked ~~on both faces every 8 square feet in red 1/2" text with the following information:~~ across both faces with 2-inch (51 mm) wide red stripes separated 6 inches (152 mm) from each other, and with text not less than 1/2 inch (13 mm) high, spaced so that no point on the board is more than 18 inches (457 mm) from text with the following information:

- ~~WARNING - FIRE HAZARD~~
- ~~This product must only be installed below a minimum 3.5-inch thick concrete slab on grade.~~
- ~~NOT FOR VERTICAL OR ABOVE GRADE APPLICATIONS~~
- ~~This product contains NO flame retardants~~
- ~~Not tested for flame spread or smoke development requirements of the model building codes~~
- CAUTION: Combustible. Do not expose to flame or ignition sources.
- Install only below a minimum 3.5- inch thick concrete slab on grade .
- Store and use in accordance with applicable building codes.

2. Each package shall be marked ~~on at least two sides in red 1/2" text~~ across not less than four sides with 2-inch (51 mm) wide red stripes separated 6 inches (152 mm) from each other, and with text not less than ½-inch (13 mm) high with the following information:

- ~~WARNING – COMBUSTIBLE MATERIAL~~
- ~~Keep away from ignition sources~~
- ~~Maintain code required separation between product storage and structures under construction (minimum 30 feet).~~
- CAUTION: Combustible. Do not expose to flame or ignition sources.
- Install only below a minimum 3.5- inch thick concrete slab on grade .
- Store and use in accordance with applicable building codes.

Commenter's Reason:
RB131-19 allows builders the choice to use flame retardant-free EPS and XPS insulation beneath a concrete slab on grade.

The committee supported allowing a healthier product with a market demand and a history of safe use in Europe. The committee voted for disapproval largely over concerns with the marking of flame retardant-free insulation. Some committee members were also concerned that identification of this material would be unclear or pose a burden on building officials.

This modification addresses the major objections from the committee regarding marking language, inspection, and potential misuse. The marking language has been simplified and aligned with industry standards for foam insulation products.

The proposed marking provisions in R316.1 have been revised.

- Red striping is required on flame retardant-free insulation boards. With the required text, this mark will make these boards readily identifiable. This modification will minimize both the potential for misapplication and the burden to inspectors.
- Redundant language and references to the "model building code" were removed.
- Required frequency of marking text is defined in a manner consistent with existing IRC language (e.g., E3091.2.1).
- The California Association of Building Officials (CBOAC) were co-proponents of the proposal, indicating their belief that the required marking facilitates inspection.

Applicable standards exist for construction sites.

- The committee expressed concern about NFPA 241, which regulates material spacing on work sites, not being in the code.
- The reference to the NFPA 241 spacing requirement has been removed, maintaining the IRC as a stand-alone code. Worksite-related marking refers to “applicable building codes,” as is standard for insulation products.
- Construction sites are generally beyond the purview of the IRC and well-regulated by other codes.

The proposed change is necessary to use flame retardant-free EPS/XPS insulation.

- The present code requires all foam plastic insulation to meet the flame spread and smoke development requirements in R316.3. Without Exception 2 for below-slab applications, foam plastic insulation products without flame retardants cannot be used.
- Committee members agreed the was no fire safety hazard in this application, stating, "Insulation under 3-1/2 inches of concrete shouldn't be a problem."

This proposal is within the scope of the IRC.

- The International Association of Fire Fighters support this proposal to reduce the unnecessary use of flame retardants which could harm their health.
- When there is no fire safety benefit (as is the case for flame retardants in below-slab insulation) there is no rationale for a requirement leading to the use of flame retardants.
- The language of intent of the IRC states: “The purpose of this code is...to safeguard the public safety, health and general welfare...from...hazards attributed to the built environment.” I-codes limit exposure to other toxics based on evidence that materials present health hazards.

Figure. Examples of to-scale marking layouts on a 4-foot by 8-foot insulation board that comply with this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Because this code change is not mandatory, there would be no required increased or decreased costs.

Public Comment# 1266

Public Comment 2:

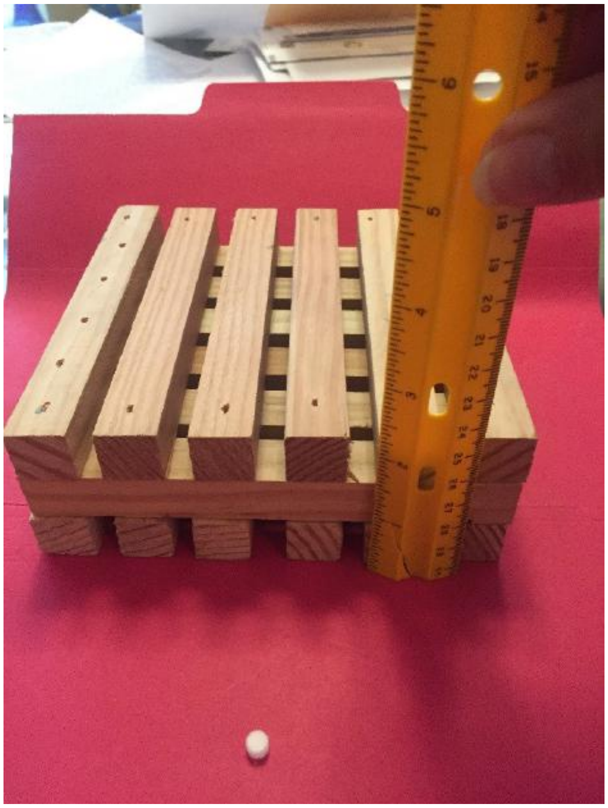
Proponents:
Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

requests Disapprove

Commenter's Reason: The basic reason that I, Marcelo M. Hirschler, request continued disapproval of this proposal is that the proposed change will decrease fire safety. The following details are based on the flawed Oklahoma State University (OSU) report commissioned by the California State Fire Marshal.

1. The OSU project demonstrated that fire retarded EPS (expanded polystyrene) foam was much less easily ignited than non-fire retarded expanded polystyrene (Non-FR EPS) foam.

2. The difference in ignition performance found by the OSU project was not minimal but very substantial. In detail, the ignition source in ASTM D2859 (which ignited the Non-FR EPS foam) is a methenamine pill that weighs 150 mg and has the approximate size of a shirt button (meaning that about 200 pills weigh an ounce) while the Class B ignition source from ASTM E108 (which was needed to ignite the FR EPS) is solid wood that weights 500 g (over a pound). There is no realistic comparison between the ease of ignition of the FR EPS foam and the Non-FR EPS foam. The photograph below has the methenamine pill on the left (in white) and the Class B ignition source (wood) on the right. The picture below that shows the two ignition sources from a different angle. The picture below that shows a bottle of methenamine pill ignition sources,



3. The ASTM D2859 test (also known as 16 CFR 1630) is the minimal fire test that any carpets and rugs sold in the US are required to meet, as mandated by the federal government and regulated by CPSC. It is an irrelevant test for anything else and it is amazing that a product that fails that test is proposed for use.

4. The difference in flame spread resulting from applying the methenamine pill to FR EPS foam and Non-FR EPS foam is astounding, as shown in Figure 9 of the OSU report: while very little happened to the FR foam, the non Fr foam burnt completely. The picture below shows the flame spread by the two foams, with the Non-FR one on the left.

Figure 9 FR EPS vs Non-FR EPS Methenamine Pill Test ASTM D2859

5. The OSU project developed a very arbitrary classification of fire risk that is not in compliance with any standard definition of fire risk (which is defined in ASTM E176 (Standard Terminology of Fire Standards) as "an estimation of expected fire loss that combines the potential for harm in various fire scenarios that can occur with the probabilities of occurrence of those scenarios"). Fire risk assessment must follow the guidance of ASTM E1776 (Standard Guide for Development of Fire-Risk-Assessment Standards) but no such analysis was made by OSU.

6. Assuming that the OSU fire risk classification is acceptable, one aspect of the classification is that it shows that Non-FR EPS has a higher fire risk than FR EPS.

7. A further result of the OSU classification is, interestingly, that Non-FR EPS also has a higher fire risk than both FR polyethylene sheet and Non-FR polyethylene sheet. That means that Non-FR EPS has a higher fire risk than a product that the CA Fire Chiefs believe is unsafe and that they have required to be deleted from the International Fire Code (IFC). The IFC accepted a proposal that all tarpaulins used in construction must meet ASTM E84 Class A or exhibit a very low heat release, both fire properties that polyethylene sheets will not meet (independently of whether they are or not FR treated). If the CA code change is approved it introduces a product less fire safe than other products not permitted in construction.

8. The OSU project criticized the fire tests known as the oxygen index (or LOI, ASTM D2863) and the Steiner tunnel (or ASTM E84) but conducted no tests with either standard. However, the results from those maligned tests indicate the same as the OSU project results, and others: FR foam plastic exhibits better fire performance than Non-FR foam plastic (as evidenced by a higher oxygen index in ASTM D2863, a lower flame spread index in ASTM E84 and a lower heat release in heat release tests), and thus results in lower fire risk, something implicitly admitted in the report.

9. The OSU report did not measure heats of combustion and used book data, assuming that adding fire retardants does nothing to heat of combustion: that is incorrect. In fact, adding fire retardants will decrease the heat of combustion (and the heat release) as shown in a paper by Hirschler referenced by the report, but ignored (“Flame Retardants and Heat Release: Review of Traditional Studies on Products and on Groups of Polymers”, M.M. Hirschler, Fire and Materials (Article published online, Fire and Materials, 03/11/2014, DOI: 10.1002/fam.2243), 2014).

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# 1371

Public Comment 3:

Proponents:
Jay West, American Chemistry Council, representing Energy Efficient Foam Coalition (jay_west@americanchemistry.com)

requests Disapprove

Commenter's Reason: The Energy Efficient Foam Coalition (EEFC) supports the result of the Committee Action Hearing to disapprove RB 131-19. As noted multiple times in testimony, there are significant concerns around the potential misuse of non-flame retarded insulation when both listed (third party fire tested) and non-flame retarded (non-fire tested) foam insulation products are on the same job site. The unintended but foreseeable substitution of non-flame retarded insulation into other applications (such as installation on a vertical surface) would greatly enhance fire hazard.

In addition, RB 131-19 does not address the inherent risks and adequacy of existing fire protection schemes at manufacturing, storage, and retail facilities to protect flame retarded foam plastic insulation. We are not aware of any bulk storage testing of palletized non-flame retarded insulation board products, which could lead to unknown hazards in these facilities for customers, workers, and first-responders in the event of a fire. The presence of non-flame retarded foam plastic insulation bundles also creates a greater fire hazard when stored on the construction site prior to use. In the event of a fire, non-flame retarded insulation could create a fire that develops and spreads rapidly to other building materials.

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# 1980

Public Comment 4:

Proponents:
John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests Disapprove

Commenter's Reason: XPSA supports the Committee action for disapproval for these reasons:

1. The RB131-19 proposal would permit any type of polystyrene foam insulation. But, the technically flawed Oklahoma State University (OSU) report, used to support this code change proposal, did not evaluate the fire performance of extruded polystyrene foam insulation (XPS) without flame retardant (non-FR).
2. The OSU fire test laboratory is not accredited by the International Accreditation Services (IAS).
3. The OSU fire test report on non-FR EPS demonstrates that non-FR EPS is a more significant fire hazard than the current code compliant flame retarded EPS insulation (FR EPS).
4. The Committee correctly pointed out that product composition or regulation of chemicals is not under the scope of the building code.
5. The US EPA has approved use of 3 flame retardants in both XPS and EPS (See: https://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf)

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# 1964

RB139-19

IRC: 202 (New), R320.1, R320.1.1

Proposed Change as Submitted

Proponents: Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

2018 International Residential Code

SECTION R320 ACCESSIBILITY

Revise as follows:

R320.1 Scope. Where there are four or more *dwelling units* or sleeping units in a single structure, the provisions of Chapter 11 of the *International Building Code* for Group R-3 shall apply. For the purpose of applying the requirements of Chapter 11 of the *International Building Code* , guestrooms shall be considered to be sleeping units.

Exceptions:

1. A *multistory dwelling unit* that is not provided with elevator service is not required to comply with this section.
2. Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the *International Residential Code* are not required to comply with this section.

Delete without substitution:

~~**R320.1.1 Guestrooms.** A *dwelling* with guestrooms shall comply with the provisions of Chapter 11 of the International Building Code for Group R-3. For the purpose of applying the requirements of Chapter 11 of the International Building Code, guestrooms shall be considered to be sleeping units.~~

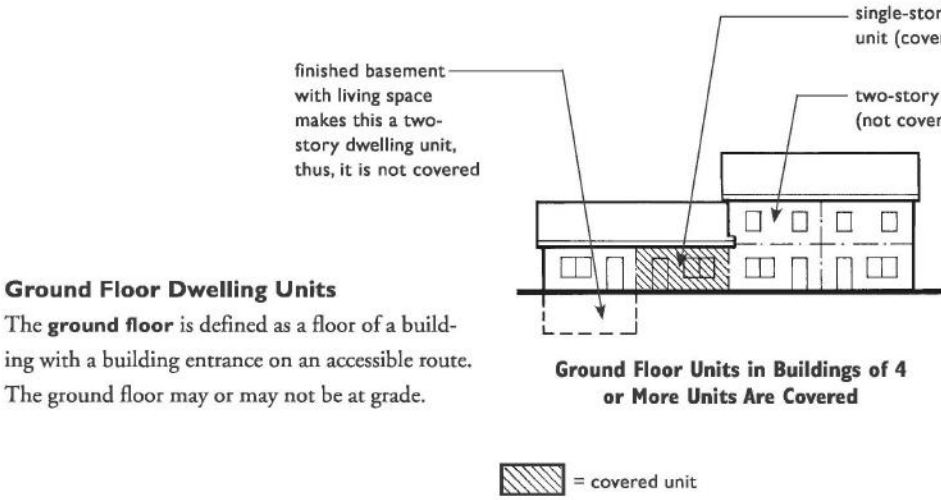
~~**Exception:** Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the International Residential Code are not required to be accessible.~~

Add new definition as follows:

MULTISTORY UNIT. A *dwelling unit* or *sleeping unit* with *habitable space* located on more than one *story*.

Reason: Chapter 11 of the IBC exempts owner-occupied lodging houses with no more than five sleeping units and multistory dwelling units not provided with elevator service. IRC, Section 320 currently only mentions lodging houses being exempt. Therefore, this proposed amendment is intended to clarify, without the designer having to refer to both Section 320 of the IRC and Chapter 11 of the IBC, multistory dwelling units not provided with elevator service are not required to comply.

The following illustration from the Fair Housing Act Design Manual visually depicts which units are "covered" by the act, and which are "not covered." It also depicts the scope of Chapter 11 of the IBC and the intent of this amendment.



Bibliography: International Building Code, International Code Council, published in September 2018
Fair Housing Act Design Manual, U.S. Department of Housing and Urban Development, published in August 1996, revised in April 1998.

Cost Impact: The code change proposal will decrease the cost of construction
This proposal will decrease the cost of design and construction by eliminating potential misinterpretation and unnecessary regulation.

RB139-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: RB140-19 is preferred and conflicts with this proposal. (Vote: 8-3)

Assembly Action: **None**

RB139-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 202 (New), R320.1

Proponents:
Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

MULTISTORY UNIT A dwelling unit or sleeping unit with habitable space located on more than one story.

R320.1 Scope. Where there are four or more *dwelling units* or sleeping units in a single structure, the provisions of Chapter 11 of the International Building Code for Group R-3 shall apply.

Exception: A multistory dwelling unit or sleeping unit that is not provided with elevator service is not required to comply with this section.

Commenter's Reason: The committee disapproved this proposal because of the overlap with RB140-19, however there is an distinct separate idea in RB139-19 that should move forward. IBC Section 1107.7.2 exempts multi-story townhouses without elevator service. Putting that exception in the IRC just eliminates a need to go to the IBC. This is similar to the exception already approved for lodging houses in RB140-19.

This public comment 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. Since 2017 the BCAC has held 6 open meetings. In addition, there were numerous Working Group meetings and conference calls for the current code development cycle, which included members of the committee as w ell as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/codedevelopment-process/building-code-actioncommitteebcac.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This matches existing allowances in the IBC for accessibility.

Public Comment# 1319

Public Comment 2:

Proponents:
Steven Mickley, representing American Institute of Building Design (steve.mickley@aibd.org)

requests As Submitted

Commenter's Reason: The committee disapproved this proposal because of perceived conflict and overlap with RB140-19. However, each address distinctly different aspects of the code and the ideas in RB139-19 should move forward.

- Voting "yes" for RB139-19 would have zero effects on RB140-19, just as voting "yes" on RB140-19 would have zero effects on RB139-19. Furthermore, voting "yes" for both proposals would create a text that works seamlessly and applies both ideas to the code - clarity of the current multistory unit exemption and keeping up with the revised scope of the IRC.
- Structurally, both RB139-19 and RB140-19 edit "R320.1 Scope." identically and strike "R320.1.1 Guestrooms." in its entirety. The distinct differences lie in RB140-19's inclusion of a new section, "R320.2 Live/Work units." Which is irrelevant to RB139-19's intent to add a second exemption, "A multistory unit that is not provided with elevator service."
- Section 1107.7.2 of the IBC currently exempts multistory units without elevator service, therefore RB139-19 eliminates a need to reference the IBC. This is similar to the exemption currently offered in R320 for lodging houses, which is also still included in RB140-19.

Both RB139-19 and RB1490-19 offer greatly needed improvements to the IRC without overlap or conflict. Therefore, the American Institute of Building Design encourages the approval of both proposals.

The following is an example of both RB139-19 and RB140-19 seamlessly entered into the text of the code without any modifications to either proposal.

R320.1 Scope. *Where there are four or more dwelling units or sleeping units in a single structure, the provisions of Chapter 11 of the International Building Code for Group R-3 shall apply. For the purpose of applying the requirements of Chapter 11 of the International Building Code, guestrooms shall be considered to be sleeping units.*
Exceptions:
1. Owner-occupied lodging houses with five or fewer guestrooms constructed in accordance with the International Residential Code are not required to comply with this section.
2. A multistory dwelling unit that is not provided with elevator service is not required to comply with this section.

R320.2 Live/work units. *In live/work units, the nonresidential portion shall be accessible in accordance with Sections 419.7 and 419.9 of the International Building Code. In a structure where there are four or more live/work units, the dwelling portion of the live/work unit shall comply with Section 1107.6.2.1 of the International Building Code.*

Add new definitions as follows:

LIVE/WORK UNIT. *A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant.*

MULTISTORY UNIT. *A dwelling unit or sleeping unit with habitable space located on more than one story.*

SLEEPING UNIT. *A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.*

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 cost impact, the intent of the proposal is to provide clarification, only.

Public Comment# 1948

RB141-19

IRC®: R309.3, R322.1.6, R322.2.1, R322.2.2, R322.2.2.1, R322.3.2, R322.3.5, R322.3.6, R322.3.7

Proposed Change as Submitted

Proponents: Gregory Wilson, representing Federal Emergency Management Agency (gregory.wilson2@fema.dhs.gov); Rebecca Quinn, RCQuinn Consulting, on behalf of Federal Emergency Management Agency, representing Federal Emergency Management Agency (rcquinn@earthlink.net)

2018 International Residential Code

Revise as follows:

R309.3 Flood hazard areas. For buildings located in flood hazard areas as established by Table R301.2(1), garage floors shall be one of the following:

1. Elevated to or above the ~~design flood~~ required lowest floor elevation as determined in accordance with Section R322.
2. Located below the ~~design flood~~ required lowest floor elevation provided that the floors are at or above *grade* on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, *equipment* and components; heating, ventilating, air-conditioning and plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* shall meet the requirements of this section. Systems, fixtures, and *equipment* and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Locating electrical systems, *equipment* and components; heating, ventilating, air-conditioning; plumbing *appliances* and plumbing fixtures; *duct systems*; and other service *equipment* is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the ~~design flood~~ required elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the electrical part of this code for wet locations.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

Exception: Enclosed areas below the ~~design flood~~ elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below ~~design flood~~ required elevation. Enclosed areas, including crawl spaces, that are below the ~~design flood~~ elevation required in Section R322.2.1 shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:
   2.1. The total net area of nonengineered openings shall be not less than 1 square inch (645 mm^2) for each square foot (0.093 m^2) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the openings shall be designed as engineered openings and the *construction documents* shall include a statement by a registered *design professional* that the design of the openings will provide for equalization of hydrostatic flood forces on *exterior walls* by allowing for the automatic entry and exit of floodwaters as specified in Section 2.7.2.2 of ASCE 24.
   2.2. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.
   2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area~~ below the design flood elevation~~, each area shall have openings.
2. The bottom of each opening shall be not more than 1 foot (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.
3. Openings shall be permitted to be installed in doors and windows; doors and windows without installed openings do not meet the requirements of this section.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the ~~design flood ~~elevation <u>required in this section </u>shall meet the requirements of Sections R322.3.5 and R322.3.6.

R322.3.5 Walls below ~~design flood~~ <u>required</u> elevation. Walls and partitions are permitted below the ~~elevated floor~~ <u>elevation required in Section R322.3.2</u>, provided that such walls and partitions are not part of the structural support of the building or structure and:

1. Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the *construction documents* shall include documentation prepared and sealed by a registered *design professional* that:
   - 4.1. The walls and partitions below the ~~design flood~~ <u>required</u> elevation have been designed to collapse from a water load less than that which would occur during the base flood.
   - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.
5. Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.

R322.3.6 Enclosed areas below ~~design flood~~ <u>required</u> elevation. Enclosed areas below the ~~design flood ~~elevation <u>required in Section R322.3.2</u> shall be used solely for parking of vehicles, building access or storage.

R322.3.7 Stairways and ramps. Stairways and ramps that are located below the lowest floor elevations specified in Section R322.3.2 shall comply with one or more of the following:

1. Be designed and constructed with open or partially open risers and guards.
2. Stairways and ramps not part of the required means of egress shall be designed and constructed to break away during design flood conditions without causing damage to the building or structure, including foundation.
3. Be retractable, or able to be raised to or above the lowest floor elevation, provided that the ability to be retracted or raised prior to the onset of flooding is not contrary to the means of egress requirements of the code.
4. Be designed and constructed to resist flood loads and minimize transfer of flood loads to the building or structure, including foundation.

Areas below stairways and ramps shall not be enclosed with walls below the ~~design flood ~~elevation <u>required in Section R322.3.2</u> unless such walls are constructed in accordance with Section R322.3.5.

Reason: The primary aspect of elevated homes in flood hazard areas that contributes to reducing damage is the elevation of the lowest floor (R322.2.1) or lowest horizontal structural member of the lowest floor in Zone V and Coastal A Zones (R322.3.2) relative to the base flood elevation. The higher the floor, the lower the risk (and the lower are NFIP flood insurance premiums). To ensure the same level of protection is applied to all

aspects of dwellings, Section R322.1.6 requires mechanical, plumbing and electrical equipment to be located at or above the required elevations, and R322.1.8 requires use of flood damage-resistant materials below the required elevations. This same level of protection should apply to enclosures and walls below the required elevations. Currently, the level of protection for enclosures and walls is at the design flood elevation, which may be lower than the lowest floor elevations required in R322.2.1 and R322.3.2.
This proposal is consistent with ASCE 24, in which each table specifying elevations refers not to the elevation of the flood, but the required elevation of the lowest floor (ow lowest horizontal structural member of the lowest floor). This proposal is consistent with the NFIP regulations which, in Section 60.3(c)(5) specifies…. “fully enclosed areas below the lowest floor…” and Section 60.3(e)(5) which specifies….”space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls …”.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Most enclosures below elevated buildings in flood hazard areas are constructed with all elements required for enclosures applied below the elevated lowest floor, thus no change in cost of construction. There may be a slight increase in cost in those rare situations where someone determines the DFE/BFE and “precisely” applies the regulations up to that elevation rather than up to the actual elevation of the lowest floor.

RB141-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This takes out "design flood" and puts in "required elevation," but does not change technical requirements. The proposal is consistent with ASCE 24. (Vote: 7-4)

Assembly Action: **None**

RB141-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R309.3, R322.2.1, R322.3.2

Proponents:
Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R309.3 Flood hazard areas. Garages and carports ~~For buildings~~ located in flood hazard areas as established by Table R301.2(1) shall be constructed in accordance with Section R322.~~, garage floors shall be one of the following:~~

1. ~~Elevated to or above the required lowest floor elevation as determined in accordance with Section R322.~~
2. ~~Located below the required lowest floor elevation provided that the floors are at or above *grade* on not less than one side, are used solely for parking, building access or storage, meet the requirements of Section R322 and are otherwise constructed in accordance with this code.~~

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including *basement*) elevated to a height above the highest adjacent *grade* of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.

3. Basement floors that are below *grade* on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

4. Garage and carport floors shall comply with one of the following:

   4.1 They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.

   4.2 They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

Exception: Enclosed areas below the elevation required in this section, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. Garages used solely for parking, building access or storage, and carports, shall comply with Item 1, or shall be at or above grade on not less than one side and, if enclosed with walls, such walls shall comply with Item 6.

4~~3~~. The use of fill for structural support is prohibited.

5~~4~~. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.

6~~5~~. Walls and partitions enclosing areas below the elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

Commenter's Reason: The purpose of this public comment is to address potential confusion introduced by relating the location of a garage or carport floor to the lowest floor elevation determined in accordance with Section R322.
Garages and carports can be either attached in part or in whole to an adjacent dwelling or detached and completely independent of the dwelling. In all cases, they can be constructed such that the garage or carport floor or slab is at or above the elevation required by R322. The garage or carport floor may be elevated to the same level as the lowest floor of an attached or adjacent dwelling, or to another level that is still above the BFE+1 or DFE.

However, most garages and carports are only used for parking, building access or storage, and thus the floor of the garage or carport - generally a concrete slab on grade - is permitted by the NFIP to be below the BFE or DFE as long as the garage or carport floor is above grade on not less than one side. In this case, the key elevation in question is that of the finished grade around the carport or garage. There is no sense in relating the placement of the carport or garage slab to the lowest floor elevation of the adjacent house, which may be several feet higher and accessed up a set of steps or ramp.

Further, there appears to be no particular reason why flood elevation requirements for garages and carports are "parked" in Section R309, away from the rest of the flood resistant construction requirements. Hence, this comment relocates the elevation requirements to the appropriate sections of R322 (R322.2.1 for Zone A and R322.2.2 for Zone V/Coastal A Zone), leaving a pointer behind in R309. In doing so, this allows for rewriting the elevation requirements to be more clear, using the opportunity to parallel the standard elevation requirement (e.g. R322.2.1 Item 1) and the requirement based on surrounding grade (e.g. R322.2.1 Item 2). This also creates a similar construct to the way ASCE 24 Section 9.2 presents requirements for attached and detached garages and carports.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As noted in the proponent's original cost impact statement, the changes in RB141 would increase the cost of construction if a builder is using the DFE or BFE itself in applying enclosure requirements, rather than the actual lowest floor elevation which may be a few feet higher. The public comment could reduce the cost impact slightly by clarifying the requirements of the NFIP and IRC as they relate to where a garage or carport is allowed to be below the DFE or BFE+1.

Public Comment# 1361

RB152-19

IRC®: R325.6

Proposed Change as Submitted

Proponents: Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (Jeffrey.Hinderliter@dos.ny.gov); Gerard Hathaway, New York State Department of State, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

2018 International Residential Code

Revise as follows:

R325.6 Habitable attic. A habitable attic shall ~~not~~ be considered to be a story above grade plane. ~~a story where complying with all of the following requirements:~~

1. ~~The occupiable floor area is not less than 70 square feet (17 m^2), in accordance with Section R304.~~
2. ~~The occupiable floor area has a ceiling height in accordance with Section R305.~~
3. ~~The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
4. ~~The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

Reason: The topic of habitable attics in the International Residential Code was discussed at length in previous hearings. During our code development process in New York State (which is based on the I-Codes), we have realized that allowing a habitable level above the third story above grade plane that is not considered a "story", creates both an inconsistency between the IRC and the IBC and a potential threat to the life and safety of occupants living in dwellings regulated under this code. This same change has been proposed to the New York State Uniform Building Code Council for consideration.

1. The current allowance for a "habitable attic" in the IRC creates an inconsistency within the I-Codes.

In its introduction, the IRC states the IRC is "fully compatible with all the International Codes® (I-Codes®) published by the International Code Council® (ICC)®, including the International Building Code®." The IRC also states in the section entitled "Effective Use of the International Residential Code" the following:

"All buildings within the scope of the IRC are limited to three stories above grade plane. For example, a four-story single-family house would fall within the scope of the International Building Code® (IBC®), not the IRC."

Traditionally, the scope of the Residential Code has been limited to three-stories. The IRC currently allows additional habitable spaces within one- and two-family dwellings and townhouses that enlarge the size of a dwelling while still considering it a "three-story": a habitable attic and story below grade plane (a basement). With a habitable attic not considered a story, a dwelling can now have 5 habitable levels, which we believe conflicts with the scope and intent of the Residential Code. It should be noted that there is no limit to the area of a habitable attic. The occupiable floor area and ceiling height requirements in Items 1 and 2 of Section R325.6 are just minimums required for habitable space. For example, a modest footprint three story dwelling with a cape cod style roof, could easily accommodate two bedrooms and a bathroom on the fourth habitable level above grade plane. A larger estate size dwelling could have as much space on that fourth habitable attic level as a small ranch style house.

As justification for this position, consider that the 2015 International Building Code® Illustrated Handbooks contains the following definition of an attic:

***ATTIC**. Several provisions apply to the attic area of a building, such as those relating to ventilation of the attic space. In order to fully clarify that portion of a building defined as an attic, Chapter 2 identifies an attic as that space between the ceiling beams at the top story and the roof rafters. An attic designation is appropriate only if the area is not considered occupiable. Where this area has a floor, it would be defined as a story. A common misuse of IBC terminology is the designation of a space as a habitable or occupiable attic. Such a designation is inappropriate insofar as once such a space is utilized for some degree of occupancy; it is no longer deemed an attic.*

(Source: "2015 International Building Code® Illustrated Handbook" by The International Code Council® (ICC®), Douglas W. Thornburg, AIA, C.B.O., John R. Henry, P.E. Published by McGraw-Hill Education. Accessed through Access Engineering, a service of McGraw-Hill Education)

While this handbook is not enforceable, it acts as a commentary on the IBC and provides guidance as to how the IBC views individual provisions and definitions. As stated above, the IBC considers a space an attic when it "is not considered occupiable". When a space becomes "habitable or occupiable" it is considered a story in the IBC. Hence, a three story one-family dwelling with a habitable attic would be considered a four-story building in the IBC.

There appears to be a conflict between how the IBC and the IRC views the same space. This conflict is allowing the creation of a space under the IRC which would require additional safety measures if built under the IBC. The IBC currently does not have a definition for a "habitable attic" nor any provisions that would allow this space to not be considered a story. Historically, the I-Codes have treated an attic that is habitable as a story.

2. Allowing the creation of a habitable attic, but not considering it an additional story, is allowing a structure that potentially creates

unmitigated life-safety hazards.

The IRC currently restricts one- and two-family dwellings and townhouses to be three-stories above grade plane with an unlimited area. For comparison purposes, this is consistent with the R-3 occupancy classification of the IBC. The Tables 504.3 and 504.4 of the 2018 IBC limit the building heights on R-3 occupancies to 40 feet or three stories for buildings equipped with a NFPA 13D automatic sprinkler system and 60 feet or four-stories for buildings equipped with a NFPA 13R automatic sprinkler system, respectively. It is noted that these tables were updated in the 2018 version of the IBC by a Code Action Committee of the ICC to address the consistency of the IBC (Refer to Code Change Proposal G133-15).

For a three-story, one-family dwelling with habitable space in the attic, the maximum story height is limited to 11'-7" in both the IRC and the IBC. Using both a typical story height (8'-0" ceiling height with a 1'-0" structural space) and the maximum story height, the following figures illustrate some possible building heights that can be achieved. Along with this comparison, Table 1 highlights some life-safety features that would result when these structures are constructed under either the IRC or the IBC. It should also be noted that the code currently does not bring into consideration habitable attics that include dormers or various roof styles (such as a mansard roof) that could easily blur the lines of the current definitions and create spaces that appear to miss the intentions of the original code change proposal.

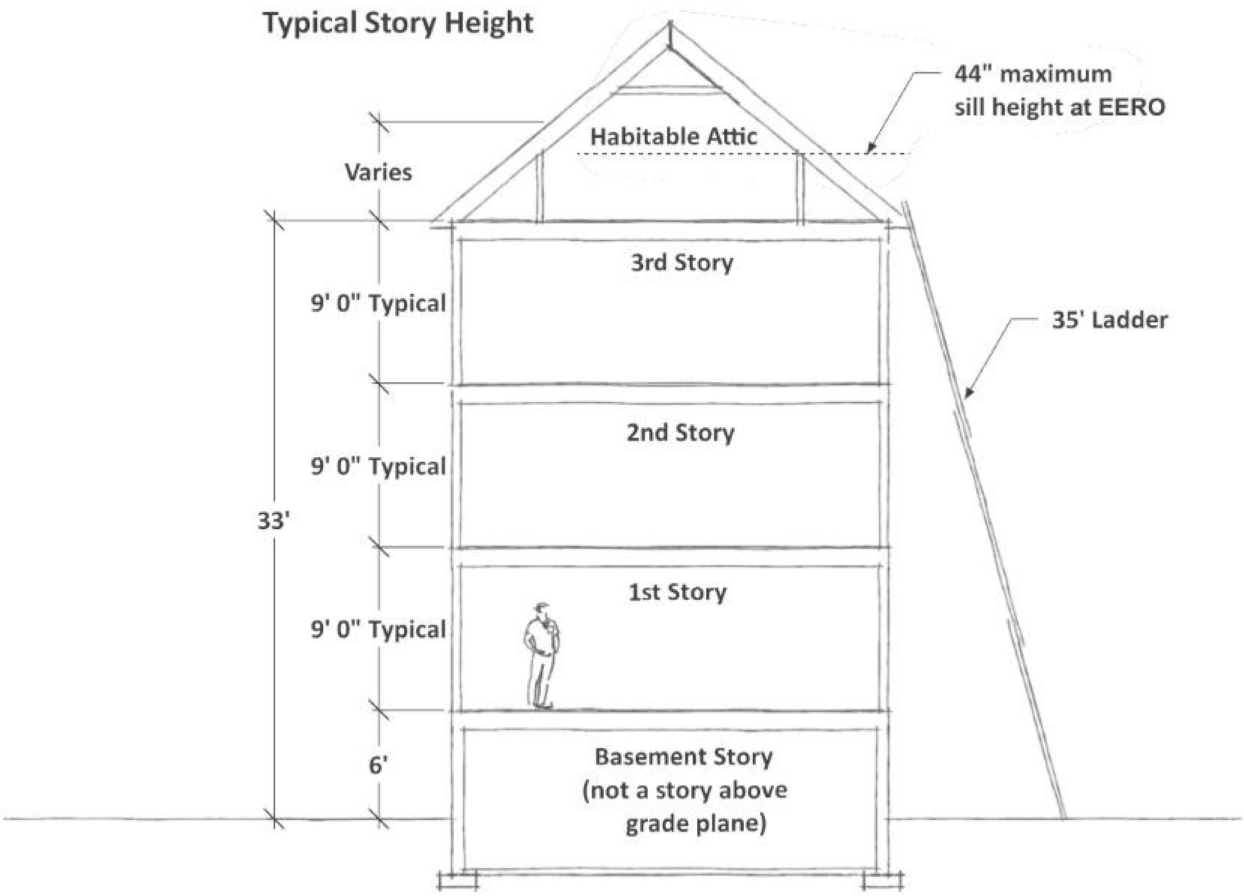


Figure 1

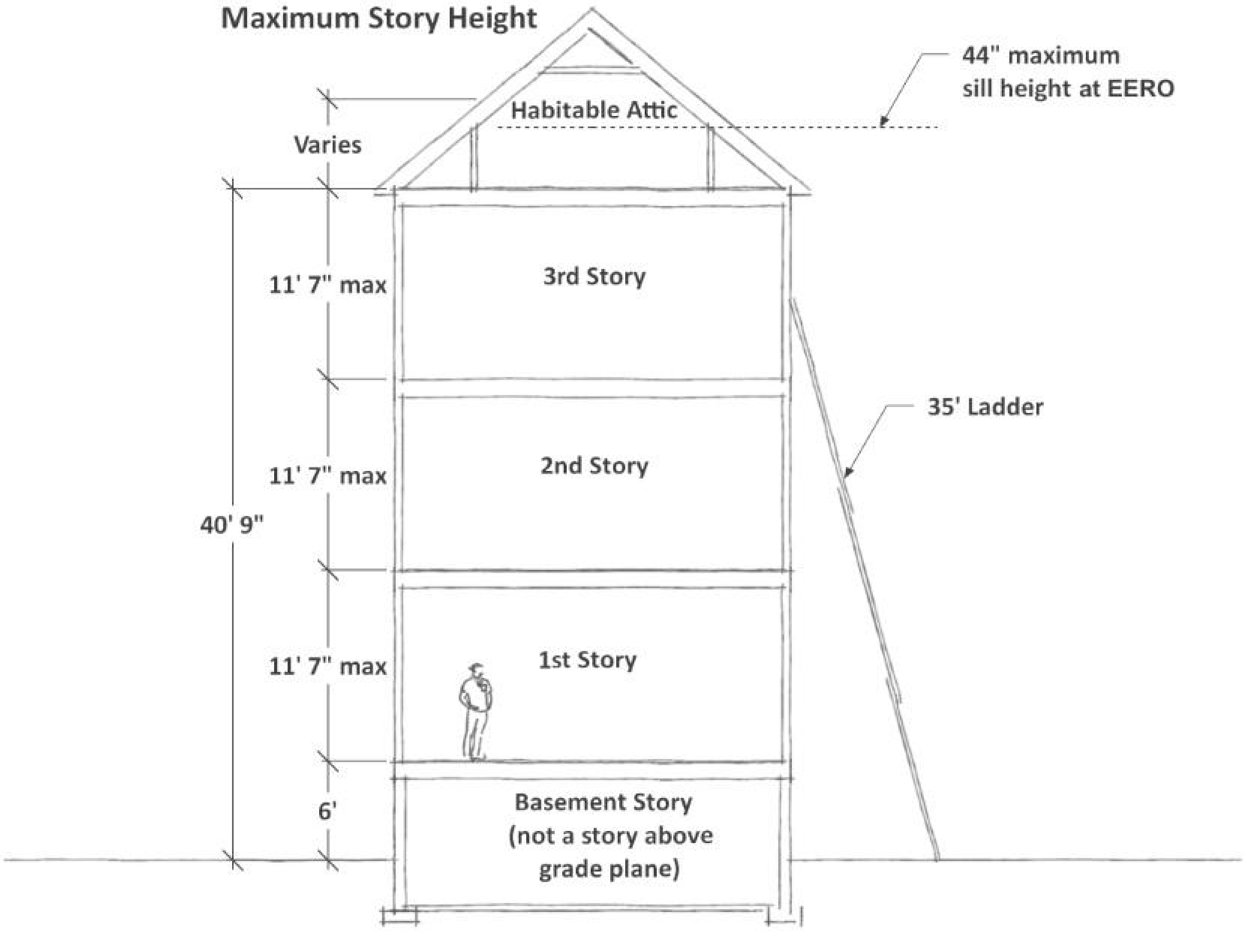


Figure 2

Table 1

Comparison of IRC Requirements to IBC Requirements for Figure 1 and Figure 2

IRC Requirements One-Family Dwelling	IBC Requirements Occupancy Group R-3
• 2018 IRC considers this a 3-Story Dwelling with a Habitable Attic • 2018 IRC Section R313.2 requires a Section P2904 or NFPA 13D sprinkler system, which results in a 10-minute sprinkler duration (P2904.5.2) • EERO required in the Habitable Attic (R310.1) • 35' ladder reaches 3rd story EERO, but may fail to reach the Habitable Attic (4th Level) EERO in Fig. 1, and fails to reach the Habitable Attic (4th Level) EERO in Fig. 2	• 4-story Dwelling • IBC Table 504.4 would require a NFPA 13R sprinkler system, with a minimum 30-minute sprinkler duration for 4-stories (NFPA 13R Section 9.2) o Alternative: Type IV or higher rated construction with an NFPA 13D system • EERO not required above the 3rd story due to their ineffectiveness at that height (IBC Section 1030.1) • 35' ladder reaches 3rd story EERO, but may fail to reach the Habitable Attic (4th Level) EERO in Fig. 1, and fails to reach the Habitable Attic (4th Level) EERO in Fig. 2

As is shown in Table 1, the result of applying either the IRC or the IBC would result in different safety levels for the same structure.

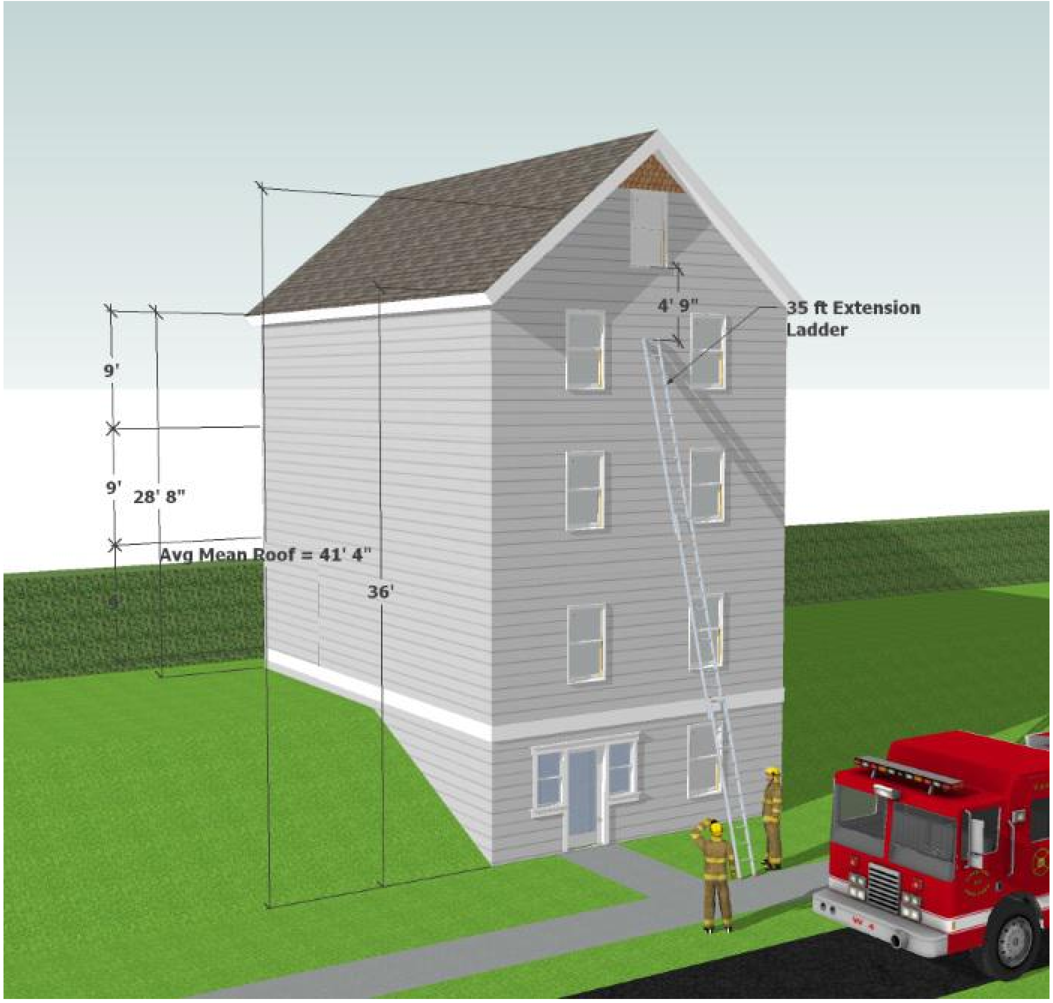


Figure 3: Walkout basement (not considered a stroy above grade plane) with typical story height, floor-to-floor, of 9’-0”

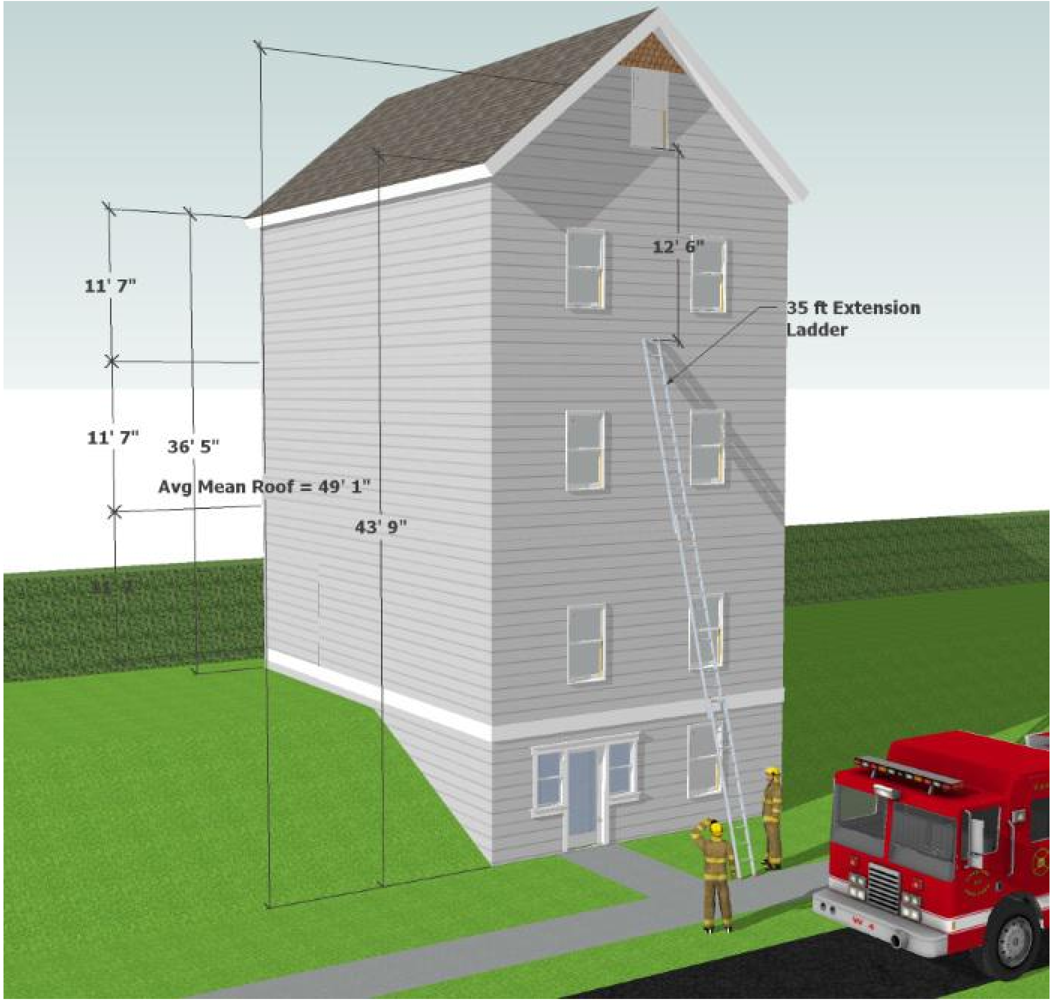


Figure 4: Walkout basement (not considered a stroy above grade plane) with maximum prescriptive story height, floor-to-floor, of 11’-7”

To correct this inconsistency, we recommend altering the IRC to consider a habitable attic a story above grade plane, as has been the historical interpretation of the IRC, and is the current practice of the IBC. The change would require new dwellings that exceed the three-story limit permitted under the IRC to be constructed to meet the structural and life-safety standards of the IBC. This will increase the safety of these tall dwellings and bring greater consistency across the I-Codes. We also recommend deleting the qualifying Items 1 through 4 because, once the habitable attic level is considered a story above grade plane, the qualifiers are not necessary.

We recommend the definition of, “Attic, Habitable” should remain unchanged because it differentiates that area of a building which contains “habitable space” from a typical “attic” as defined. The definition stating that a habitable attic can be finished or unfinished takes away the arguments made by those who would seek to disqualify the area in question because it is unfinished in some way. If the area is being used as habitable space, all other requirements necessary for a space to be considered habitable must be provided.

On the other hand, if the area is being used for non-habitable space such as for equipment or storage, then the owner should not be required to provide EEROs, egress stairs and other items required for habitable space, just because it has the minimum area and ceiling height requirements of a habitable space. Code enforcement officers could condition the Certificate of Occupancy for such a dwelling as a three-story structure with attic storage not approved for use as habitable space.

Bibliography: "2018 International Residential Code for one- and two-family dwellings" by The International Code Council® (ICC®). (2017). Country Club Hills, IL: International Code Council.
“2015 International Building Code® Illustrated Handbook” by The International Code Council® (ICC®), Douglas W. Thornburg, AIA, C.B.O., John R. Henry, P.E. Published by McGraw-Hill Education. Accessed through Access Engineering, a service of McGraw-Hill Education

Cost Impact: The code change proposal will increase the cost of construction
This code change, by returning to the historical interpretation and application of the IRC, would increase the cost of construction only when a habitable attic is above a third story, creating a fourth-story above grade plane. This change would potentially force some dwellings to be constructed under the IBC rather than the IRC, which would trigger height limitations and the need for higher types of construction and additional life-safety measures, including the potential to install a NFPA 13R system rather than a NFPA 13D system. This cost increase reflects the need to offset the increased risk of these structures.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is too restrictive. It should be acceptable on a 2 story house. All habitable attics should not be eliminated. (Vote: 8-3)

Assembly Action: **None**

RB152-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R325.6, R325.1, SECTION 326 (New), R326.1 (New), R326.2 (New), R326.3 (New), R326.4 (New)

Proponents:
Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R325.6 Habitable attic.** A habitable attic shall be considered to be a story above grade plane.~~

R325.1 General. Mezzanines shall comply with Sections R325 through R325.5. ~~*Habitable attics* shall comply with Section R325.6.~~

~~**R325.6 Habitable attic.** A habitable attic shall not be considered a story where complying with all of the following requirements:~~

1. ~~The occupiable floor area is not less than 70 square feet (17 m^2), in accordance with Section R304.~~
2. ~~The occupiable floor area has a ceiling height in accordance with Section R305.~~
3. ~~The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
4. ~~The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

SECTION 326
HABITABLE ATTICS

R326.1 General. *Habitable attics* shall comply with Sections R326.2 through R326.4.

R326.2 R326.2 Minimum Dimensions. A *habitable attic* shall have a floor area in accordance with R304 and a ceiling height in accordance with R305

R326.3 Story Above Grade Plane. A *habitable attic* shall be considered to be a story above grade plane.

Exception: A *habitable attic* shall not be considered to be a story above grade plane provided that the *habitable attic* meets all of the following:

1. The aggregate area of the *habitable attic* is
   not be greater than one-third of the floor area of the story below or is not be greater than one-half of the floor area of the story below where the *habitable attic* is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.

2. <u>The occupiable space is enclosed by the roof assembly above, knee walls,if applicable, on the sides and the floor-ceiling assembly below.</u>

3. <u>The floor of the *habitable attic* does not extend beyond the exterior walls of the story below.</u>

<u>**R326.4** **Means of egress.** The means of egress for *habitable attics* shall comply with the applicable provisions of Section R311</u>

Commenter's Reason: We agree with the original proposal and most of the testimony given a the CAH with limiting the size, but still allowing some habitable attics to not be considered a story above grade plane.
This public comment finds a balance with the current specifications on habitable attics not being a considered a story and limiting the size of habitable attics to address the life safety concerns indicated by the original proposal.

This public comment creates a new section for habitable attics, maintains and reorganizes the existing specifications for habitable attics, and includes a size limitation on habitable attics.

This public comment captures the issues identified by the Committee that they recommended for developing a public comment and addresses the various testimonies for and against the original proposal.

We have provided an attachment that shows how the Section should be formatted since cdpACCESS does not capture the correct formatting.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment would increase the cost of construction where habitable attics are large enough to be considered a story above grade plane.

Public Comment# 1490

Public Comment 2:

IRC®: R325.6, P2904.1.1

Proponents:
Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R325.6 Habitable attic. A habitable attic shall be considered to be a story above grade plane.

P2904.1.1 Required sprinkler locations. Sprinklers shall be installed to protect all areas of a *dwelling unit*.

Exceptions:

1. <u>Uninhabitable</u> attics, crawl spaces and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In <u>uninhabitable</u> *attics*, crawl spaces and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be installed above the equipment; however, sprinklers shall not be required in the remainder of the space.
2. Clothes closets, linen closets and pantries not exceeding 24 square feet (2.2 m^2) in area, with the smallest dimension not greater than 3 feet (915 mm) and having wall and ceiling surfaces of gypsum board.
3. Bathrooms not more than 55 square feet (5.1 m^2) in area.
4. Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.

Commenter's Reason: We agree with the original proposal and the testimony at the CAH to provide public comments addressing some concerns with the proposal. This public comment addresses one of the items left out of the original proposal by clearly identifying the type of attics where sprinklers are not required. When sprinklers are required in habitable spaces, habitable attics should be included since they are required to meet the habitable dimension requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment could increase the cost of construction since, if sprinklers are required, they would need to be installed in habitable attics.

Public Comment 3:

IRC®: R325.6, R325.1, SECTION R326 (New), R326.1 (New), R326.2 (New), R326.3 (New)

Proponents:
Micah Chappell, representing Washington Association of Building Officials (micah.chappell@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R325.6 Habitable attic.** A habitable attic shall be considered to be a story above grade plane.~~

R325.1 General. Mezzanines shall comply with Sections R325 through R325.5. ~~*Habitable attics* shall comply with Section R325.6.~~

~~**R325.6 Habitable attic.** A habitable attic shall not be considered a story where complying with all of the following requirements:~~

1. ~~The occupiable floor area is not less than 70 square feet (17 m^2), in accordance with Section R304.~~
2. ~~The occupiable floor area has a ceiling height in accordance with Section R305.~~
3. ~~The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.~~
4. ~~The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.~~

SECTION R326
HABITABLE ATTICS

R326.1 General. *Habitable attics* shall comply with Sections R326.2 and R326.3.

R326.2 Minimum Dimensions. A *habitable attic* shall have a floor area in accordance with Section R304 and a ceiling height in accordance with Section R305.

R326.3 Story Above Grade Plane. A *habitable attic* shall be considered a story above grade plane.

Exception: A *habitable attic* shall not be considered to be a story above grade plane provided that the *habitable attic* meets all the following:

1. The aggregate area of the *habitable attic* is
   - not greater than one-third of the floor area of the story below or
   - is not greater than one-half of the floor area of the story below where the *habitable attic* is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section P2904.
2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
3. The floor of the *habitable attic* does not extend beyond the exterior walls of the story below.

Commenter's Reason: We agree with the original proposal and most of the testimony given a the CAH with limiting the size, but still allowing some habitable attics to not be considered a story above grade plane.
This public comment finds a balance with the current specifications on habitable attics not being a considered a story and limiting the size of habitable attics to address the life safety concerns indicated by the original proposal.

This public comment creates a new section for habitable attics, maintains and reorganizes the existing specifications for habitable attics, and includes a size limitation on habitable attics.

This public comment captures the issues identified by the Committee that they recommended for developing a public comment and addresses the various testimonies for and against the original proposal.

We have provided an attachment that shows how the Section should be formatted since cdpACCESS does not capture the correct formatting.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment would increase the cost of construction where habitable attics are large enough to be considered a story above grade plane.

Public Comment# 1558

Public Comment 4:

IRC®: R325.6

Proponents:
David Renn, PE, SE, City and County of Denver, representing Code Change Committee of Colorado Chapter of ICC (david.renn@denvergov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R325.6 Habitable attic. A *habitable attic* shall not be constructed above the ceiling of a third *story above grade plane.* A *habitable attic* shall not be considered ~~to be a story above grade plane.~~ to be a *story* where complying with all of the following :

1. The occupiable floor area is not less than 70 square feet (17 m^2), in accordance with Section R304.
2. The occupiable floor area has a ceiling height in accordance with Section R305.
3. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.

Commenter's Reason: Original proposal has merit since a habitable attic within a third story essentially creates a fourth story which would otherwise not be allowed in the IRC - this creates a life safety issue as outlined in the original proposal. There were many concerns raised during the committee action hearings regarding calling a habitable attic a story and it was thought that calling a habitable attic a story is too restrictive since a habitable attic (that is not considered a story) should be allowed within a first or second story. This public comment keeps the 2015 IRC requirements for when a habitable attic is not a story, and adds a restriction that habitable attics are not allowed above the ceiling of a third story. This approach gets straight to the issue at hand and the intent of the original proposal, which is to not effectively create a four story building regulated by the IRC. If this restriction is not met, the project can still be constructed under the IBC with the attic being considered a story.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of construction will increase only for projects that have a habitable attic within a third story above grade plane. These projects would have to be constructed in accordance with the IBC instead of the IRC, with cost increases as noted in the original proposal.

Public Comment# 1360

Public Comment 5:

IRC®: R325.6

Proponents:
Jeffrey Shapiro, International Code Consultants, representing Self (jeff.shapiro@intlcodeconsultants.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R325.6 Habitable attic. A habitable attic shall not be considered a story where complying with all of the following requirements:

1. The occupiable floor area is not less than 70 square feet (17 m^2), in accordance with Section R304.
2. The occupiable floor area has a ceiling height in accordance with Section R305.

3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.
4. The floor of the occupiable space shall not extend beyond the exterior walls of the floor below.
5. <u>Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section P2904.</u>

Commenter's Reason: Provisions allowing habitable attics were first included in the IRC in the 2009 edition (Proposal RB17-07/08). In the 2018 edition, the provisions were expanded to allow dormers to be included (Proposal RB166-16), eliminating the restriction that the ceiling of a habitable attic be limited to rafters/roof framing. Lacking restrictions on the height of knee walls or the size of dormers, the 2018 IRC essentially allows a habitable attic to be a “story” that’s not counted as a story. When located above the third floor, there is no legitimate differentiation between a habitable attic and a fourth story, but the habitable attic allowance provides a “free pass” to stay in the IRC and avoid the three-story limit that ordinarily kicks you to the IBC.
In the 2009 IRC, when the habitable attic provisions were added to the code, the IRC also began requiring sprinklers. Therefore, the habitable attic allowance has, by default, always been associated with and contingent on sprinklers being provided. The new Item 5 proposed by this comment will ensure that the habitable attic allowance is only permitted when sprinklers are provided, which is technically justified recognizing that: 1) Occupants located four stories above grade have a long way to go to escape against smoke and heat rising from a fire below that can block the interior stairs, and 2) Occupants four stories above grade cannot reasonably jump from escape windows or be readily rescued by fire department using ground ladders.

This comment reflects the approach taken a few years ago, when fire separations between unsprinklered townhouses were increased to 2-hours. The 2009 IRC had permitted all townhouse separations to be 1-hour because sprinklers were always required. But after it became clear that jurisdictions were not universally adopting the sprinkler requirement, the IRC was changed to reinstate a 2-hour rating for non-sprinklered buildings. In this case, the legacy approach of treating habitable attics as stories is being reinstated for non-sprinklered buildings.

In summary, it is the intent of this comment to ensure that application of the IRC remains consistent with the original allowance for habitable attics, which correlated with the requirement for sprinklers to be provided. The comment offers a reasonable and appropriate basis for continuing an allowance for habitable attics above the third story and is less punitive than the original proposal’s suggestion to completely eliminate the option.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Technically, the IRC requires all buildings to be sprinklered, so this doesn't have a cost impact with respect to the model code. In jurisdictions that amend the IRC by removing the sprinkler requirement, there would be a cost increase if the habitable attic provisions were used.

Public Comment# 2152

Public Comment 6:

Proponents:
Jeffrey Hinderliter, New York State Department of State, representing New York State Department of State (jeffrey.hinderliter@dos.ny.gov); Gerard Hathaway, representing New York State Department of State (gerard.hathaway@dos.ny.gov)

requests As Submitted

Commenter's Reason: With this public comment we are re-introducing the original proposal As-Submitted to the “Committee Action Hearings” with no changes. This additional reason statement builds on and makes reference to the original reason statement. It is obvious from the testimony and committee discussions, that there is much misunderstanding regarding what this proposed change accomplishes. We realize this reason statement is long, but please push through it for an informed vote.

<u>The Committee Reason for disapproval was as follows:</u>

This is too restrictive. It should be acceptable on a 2-story house. All habitable attics should not be eliminated.

<u>Proponent’s Response to floor testimony, Committee discussion and Reason for Disapproval.</u>

In rebuttal to the Committee Reason:

The RB152-19 (IRC R325.6) proposal does not eliminate the possibility of constructing habitable attics in one-or two-family dwellings and townhouses under the IRC up to and including above the 2nd floor. This proposal does not eliminate the possibility of constructing habitable space in attics above the 3rd floor, they would be regulated under the IBC as a 4-story dwelling with no limitations on floor area in relation to the floor below.

Where essentially you would be required to provide a better NFPA 13R sprinkler system. The cost of which is not overly burdensome when compared to the increased floor area allowed and much improved life safety features (see cost comparison at the end).

In rebuttal to floor testimony and committee discussion:

The definition of Habitable Attic is still in Chapter 2, unchanged from the 2018 IRC. It is important because it differentiates that area within the roof structure of a building which contains “habitable space” from a typical “attic” as defined. The definition, stating that a habitable attic can be finished or unfinished, takes away the arguments made by those who would seek to disqualify the area in question because it is unfinished in some way. When the area is being used for habitable space, all other requirements necessary for a space to be considered habitable must be provided.

We have simply proposed amending R325.6 Habitable Attic to call it a “story above grade plane”. We also have removed Items 1 through 4 because once we consider a habitable attic a story; Items 1 & 2 are not necessary since all habitable spaces must meet those provisions, and Items 3 & 4 are not necessary since we no longer need to limit the size and configuration of the habitable attic because “it is a story”. Enforcement becomes easier because you no longer need to be concerned if the following items which are gray areas for enforcement would disqualify a space from being considered a habitable attic, such as: providing small or large dormers, salt box, gambrel or other style roofs that create more space at that level.

Approval of the proposal would result in; a habitable attic above a 1-story dwelling would be considered a 2-story, a habitable attic above a 2-story dwelling would be considered a 3-story. However, a habitable attic above a 3-story dwelling would be considered a 4-story, which would make it beyond the scope of the IRC and would have to be regulated under the IBC. In the IBC that same habitable space whether under rafters or within a room truss is currently considered a story above grade plane. There is no Habitable Attic definition in the IBC.

This is an example of why a habitable space should not be exempted from being considered a story just because it is located under sloped rafters. Picture the 3-story dwelling shown in Figure 1 of our original reason statement with a flat roof, rather than sloped rafters above the 3rd floor. Then picture a smaller 4th level with a flat roof. Under both the current IBC and IRC that flat roof 4th level would be considered a story above grade plane, even if it were 1/3 to 1/2 the size of the area of the floor below. There is no reason why a sloped roof dwelling with a 4th level habitable attic regulated under the IRC, located next to a flat roof dwelling with a 4th story that is the same size and at the same height but regulated under the IBC should be allowed to have less fire protection features than required under the IBC. With typical wood frame (5b) construction the current IRC would allow the use of a Section P2903 sprinkler system (equivalent to NFPA 13D) with a 10-minute sprinkler duration for this 3-story building because the 4th level habitable attic is not considered a story. However, with the same type of construction the IBC would require an NFPA 13R sprinkler system because the 4th level would be considered a 4th story. The 13R sprinkler system requires additional sprinkler heads and a 30-minute sprinkler duration. Thus, giving more time to escape the taller building.

We agree with the fire service committee member who said that higher emergency escape and rescue openings (EEROs) in a 4th level or story above grade plane, that are beyond the reach of a typical 35-foot ladder, would be much riskier for both the fire fighter and the occupant (see Figure 1 of our original reason statement). The IBC does not even require EEROs above the 3rd story because they are ineffective for escape and rescue, and that is why a 13R sprinkler system is required.

The construction industry representative testified that allowing a habitable attic that is not considered a story above grade plane is needed because infill sites are typically restricted in lot size and you need to go more vertical. However, these same sites are typically in urban or coastal settings where access to fight fires may be limited to as little as one side. In locations where buildings are built that close together typically ample municipal water supply is available for sprinkler systems. The proposed change does not stop developers from going above the 3rd floor to 4 or more if the building has a higher type of construction and/or a 13R or 13 sprinkler system as shown on IBC Table 504.4. Increased life safety risks require increased life safety measures.

Townhouses are built in the same tight configuration as infill lots. Picture a row of 3-story homes, like the one shown in Figure 3 of our original reason statement, as regulated under the current IRC. Fire-fighting access could be somewhat limited. Additionally, there are often garages (adding fuel load) under the home on the walkout side. The garage level is not a story above grade plane and if the habitable attic is not considered a story above grade plane, the 5th level above where fire-fighting operations must be set up is only protected with a 13D sprinkler system with just a 10-minute sprinkler duration for the egress path down. Possibly there would be no sprinkler protection in municipalities that have opted out of the IRC sprinkler requirements.

Most states and municipalities have opted-out of the IRC sprinkler requirements. So, the only hope of protecting occupants above the 3rd story is to call a habitable attic a story above grade plane, requiring regulation under the IBC, and providing a 13R sprinkler system to help mitigate a significant life safety hazard.

It has also been suggested by many that limiting the square foot area of a habitable attic could be an acceptable compromise. Several have said that the habitable attic could be 1/3 of the area of the floor below if not sprinklered, and 1/2 of the area of the floor below if a sprinkler system is provided, similar to how mezzanines are treated. This does not make sense based on the following: According to R325.5 Openness, Exception Item 2,

a mezzanine is not required to be open to the room in which it is located when the building is equipped throughout with an automatic sprinkler system. However, this is allowed only in buildings of not more than 2-stories above grade plane. Therefore, a mezzanine is allowed in the 3rd story of a home, but must be open to the room in which it is located, even if a sprinkler system is provided. That said, why would a 4th level habitable attic, enclosed to the 3rd-floor below, be acceptable?

Consider a modest 20 X 36-foot 3-story infill building or townhouse under the current IRC. Say you provide a habitable attic at the 4th level that is 1/3 of the floor below (720 sf.), which equals 240 sf. That is enough space for two 100 plus square foot bedrooms which could sleep two children each, totaling 4 children with no sprinkler protection required in opted out municipalities. In municipalities that require sprinklers per the IRC, 1/2 of the floor below (720 sf.) would be allowed, which equals 360 sf. That is enough space for three 100 plus square foot bedrooms which could sleep two children each, totaling 6 children protected with a 13D sprinkler system with just a 10-minute sprinkler duration for the egress path down 4 levels.

We know that these rooms may be used for purposes other than children's bedrooms, but upper stories, even if used for recreation rooms are often used for sleepovers just like finished basements. The compromise does not seem very acceptable when the cost of providing an upgraded fire sprinkler system is not overly burdensome.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of upgrading from an NFPA 13D to an NFPA 13R sprinkler system with and increased cost estimated at $1.35 per square foot, or $3,594 for an averaged size house of 2,662 square feet, which represents a 1.03% cost increase.

Another more expensive option in shown in IBC Table 504.4, is to stay with an NFPA 13D sprinkler system and upgrade to a higher type of construction. The increased cost to upgrade from Vb to IIIb construction, by utilizing a fire retardant treated wood (FRTW) and type X gypsum board exterior wall assembly, is estimated at $3.64 per square foot, or $11,779 for an averaged sized house of 2,662 square feet. This represents a 3.38% cost increase.

Public Comment# 2007

RB154-19

IRC®: SECTION R202, [RB] 202, 202 (New), SECTION R327, R327.1, R327.2, R327.3, R327.3.1 (New), 327.3.2 (New), R327.3.3 (New), R327.3.4, R327.3.5, R327.3.6, R327.3.7 (New), Table R327.3.7 (New), R327.3.7.1 (New), R327.3.7.2 (New), R327.3.8 (New), R327.4 (New), R327.5 (New), R327.5.1 (New)

Proposed Change as Submitted

Proponents: Robert Davidson, Davidson Code Concepts, LLC, representing Tesla, USA (rjd@davidsoncodeconcepts.com); Kevin Reinertson, representing Riverside County Fire Department (kevin.reinertson@fire.ca.gov); Jack Applegate, representing City of Clatskanie, Oregon (jacka@nwcodepros.com)

2018 International Residential Code

SECTION R202
DEFINITIONS

Delete without substitution:

~~**[RB] BATTERY SYSTEM, STATIONARY STORAGE.** A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls and associated electrical *equipment* designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.~~

Add new definition as follows:

[RB] ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

Revise as follows:

SECTION R327
~~STATIONARY~~ ENERGY STORAGE ~~BATTERY~~ SYSTEMS

R327.1 General. ~~*Stationary storage battery system* shall comply with the provisions of this section.~~

ESS shall be installed and maintained in accordance with Sections R327.2 through R327.4. The temporary use of an owner or occupant's electric powered vehicle as an ESS shall be in accordance with Section R327.5.

R327.2 Equipment listings. ~~*Stationary storage battery systems*~~ *ESS* 1 kWh or greater in maximum stored energy shall be *listed* and *labeled* for residential use in accordance with UL 9540.

Exceptions:

1. Where *approved*, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.
2. ~~Battery systems that are an integral part of an electric vehicle are allowed provided that the installation complies with Section 625.48 of NFPA 70.~~ *ESS* listed and labeled in accordance with UL 9540 solely for utility or commercial use installed in accordance with Section 1206 of the *International Fire Code* .
3. ~~Battery systems less than 1 kWh (3.6 megajoules).~~

R327.3 Installation. ~~*Stationary storage battery systems*~~ *ESS* shall be installed in accordance with the manufacturer's instructions and their *listing*, if applicable, and shall not be installed within the living space or habitable space of a dwelling unit.

Add new text as follows:

R327.3.1 Spacing. Individual units shall be separated from each other by at least three feet of spacing unless smaller separation distances are documented to be adequate as approved by the code official based on large scale fire testing complying with Section 1206.1.5 of the International Fire Code.

327.3.2 Location. ESS shall only be installed in the locations listed in items 1 through 4.

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space and sleeping units in accordance with Section R302.6.
3. Outdoors on exterior walls or on the ground located a minimum 3 ft. from doors and windows.
4. Enclosed utility closets or spaces, or enclosed storage closets within dwelling units.

R327.3.3 Energy ratings. Individual *ESS* units shall have a maximum stored energy of 20 kWh. The aggregate rating within or outside the structure shall not exceed:

1. 40 kWh within utility closets and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1206 of the International Fire Code

Revise as follows:

R327.4 R327.3.4 Electrical installation. *Stationary storage battery systems* *ESS* shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

R327.5 R327.3.5 Ventilation. Indoor installations of *stationary storage battery systems* *ESS* that include batteries that produce hydrogen or other flammable gases during charging normal operation shall be provided with ventilation in accordance with Section M1307.4. M1307.4.2.

R327.6 R327.3.6 Protection from impact. *Stationary storage battery systems* *ESS* installed in a location subject to vehicle damage shall be protected by approved barriers.

Add new text as follows:

R327.3.7 Fire separation When located within a garage, utility closet or space, or storage closet, the garage, room or space shall be separated as required by Table R327.3.7. Attachment of gypsum board shall comply with Table R702.3.5. The wall separation provisions of Table R327.3.7 shall not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

Table R327.3.7
ESS Fire Separation

SEPARATION	MATERIAL
From the residence and attics	Not less than 1/2-inch gypsum board or equivalent applied to the garage, room or space side
From habitable rooms above the garage, room or space	Not less than 5/8-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than 1/2-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than 1/2-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

R327.3.7.1 Openings. Openings from a garage, room or space directly into a room used for sleeping purposes shall be prohobited.

R327.3.7.2 Penetrations. Penetration protection shall be provided at openings in walls, ceilings and floors around vents, pipes, ducts, cables and wires, with an approved material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E136 requirements.

R327.3.8 Fire detection. Interconnected smoke alarms shall be installed throughout the dwelling in accordance with Section R314, including in the room or area within the dwelling or attached garage in which the *ESS* are installed. A heat detector listed and interconnected to the smoke alarms shall be installed in the room or area within the dwelling or attached garage in which the *ESS* is installed where smoke alarms cannot be installed based on their listing.

R327.4 Toxic and highly toxic gas. *ESS* that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall be installed outdoors.

R327.5 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit while parked in an attached or detached garage or outside shall comply with the vehicle manufacturer's instructions and NFPA 70. The batteries on electric vehicles shall not contribute to the aggregate energy limitations in Section R327.4.3.

R327.5.1 Temporary. The temporary use of the dwelling unit owner's or occupant's electric-powered vehicle to power the dwelling while parked in an attached or detached garage or outside shall not exceed 30 days.

Reason: Last cycle the portion of the International Fire Code dealing with Stationary Battery Storage Systems was heavily rewritten by the Energy Storage Work Group of the ICC Fire Code Action Committee to address changes in technology and application of battery storage systems. When that work was accepted by the IFC Committee and the voting membership, new Section R327 was added to the International Residential Code to provide for some core requirements when the systems are installed in one- and two-family dwellings and townhouses.
Simultaneous to that work, NFPA created a new NFPA 855 Energy Storage Systems Standard for a comprehensive document addressing the hazards of energy storage systems. The ICC FCAC Energy Storage Work Group continued to work on the topic in coordination with the work being done by the NFPA 855 committee to keep the technical details of the documents as coordinated as possible. As a result, the new requirements in the 2018 edition of the IFC have been heavily updated as to structure and the topics covered.

This proposal is an outgrowth of work done by the NFPA 855 Committee specific to one- and two-family dwellings and townhouses as well as new language added to the IFC for the 2021 edition addressing R-3 and R-4 Group Occupancies.

The concerns identified for one and two-family dwellings and townhouses dealt with:

- Where the ESS units could be located.
- Energy rating maximum of individual units.
- Aggregate energy ratings when more than one unit is installed.
- Linkage to the fire code when energy limitations are exceeded.
- Fire separation.
- Fire detection.
- ESS that may produce toxic or highly toxic gases during operation.
- Temporary use of electric vehicle as ESS for the dwelling.

The breakdown of the suggested changes are as follows:

New definition: The definition for Energy Storage Systems (ESS) from the IFC has been brought over to the IRC for consistency of terminology between the IFC and NFPA 855.

R327 generally: The term Energy Storage Systems has replaced the term Stationary Storage Battery Systems.

R327.1: Has been modified to identify the sections ESS shall comply with and to add a separate pointer for the section applicable to the temporary use of an electric vehicle as an ESS.

R327.2: Has been modified to pull the exception for the systems with less than 1 kWh and provide it as the energy rating level trigger for cleaner application of the requirements. Exception 2 has been deleted since the use of electric vehicles is covered by the new section R327.5. In its place language has been added providing for the installation of utility or commercial listed systems (not listed for residential use) to be outside the dwelling and to be in accordance with the IFC. Exception 3 is deleted since that topic is now covered by the initial language at the start of R327.2.

R327.3: Has been modified to replace the current terminology with ESS, and a restriction against installation in “living space” has been added to address concerns that there are other locations such as hallways that are not covered by the existing restriction for habitable spaces. That addition provides consistency with language added o NFPA 855.

New R327.3.1: Adds a separation requirement of 3 feet between ESS units unless large scale testing has documented that an event in one unit will not propagate to the next unit.

New R327.3.2: Adds a listing of specific installation locations consistent with the IFC R-3 and R-4 locations and NFPA 855.

New R327.3.3: Provides a limitation on the maximum energy rating of an individual unit as well as an aggregate energy rating for specific installation locations. The size of an event is directly correlated to the amount of energy stored. It then provides that if increased energy above these limits is desired the installation shall be done in accordance with the IFC.

R327.3.4 (Prior R327.4): Has been modified to replace the current terminology with ESS.

R327.3.5 (Prior R327.5): Has been modified to replace the current terminology with ESS. The term “charging” has been replaced with the phrase “normal operation”. It doesn’t matter at what point the gases are produced, they need to be exhausted. Section M1307.4 was changed to Section 1307.4.2 to clarify this is a mechanical exhaust system that is required.

R327.3.6 (Prior R327.6): Has been modified to replace the current terminology with ESS.

New R327.3.7: This section has been added to address the need for fire separation. When an event occurs, it cannot always be extinguished with water. Exposures would be wetted while the unit burns itself out. For that reason, separation is needed to assist in preventing fire spread. The language from existing Section 302.6 was taken for consistency and editorially modified slightly to fit this area of the code.

New R327.3.7.1: Adds the first sentence of existing Section R302.5.1 to keep rooms or spaces with ESS from opening into areas for sleeping purposes. (The remainder of R302.5.1 concerning doors and closures is part of a separate proposal).

New R327.3.7.2: Adds language from existing Section R302.11, Item 4, (as referenced by existing R302.5.3), with editorial changes to fit this application.

New R327.3.8: Adds a requirement that when ESS is installed the dwelling must have an interconnected smoke alarm system with a smoke alarm installed in the room or space the ESS is located for early warning of an event. If the space is not conducive to the installation of a smoke alarm a listed heat alarm can be installed and interconnected to the smoke alarm system.

New R327.4: Provides that an ESS that has the potential to release toxic or highly toxic gases during normal use shall be installed outdoors.

New R327.5: Provides for the temporary use of an electric vehicle as an ESS to power the dwelling provide it is done in compliance with the NEC and the manufacturer’s instructions. The requirement for the manufacturer’s instruction compliance ensures that only electric vehicles designed and manufactured for use as an ESS are utilized as compared to someone adding non-approved electrical connections to an existing electric vehicle not designed for this purpose. Temporary is further defined as 30 days with new Section R327.5.1.

These changes will provide for correlation with the new langauage added to the IFC as well as enhancements made when the language was added to NFPA 855. This correlation provides for consistency or requirments across codes and standards.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposed change does not impact the cost of construction of one- or two-family dwellings and townhouses. ESS are specialty systems typically installed in an existing dwelling by the current owner. In the rare case that a new custom home owner desires installation of ESS as part of the construction of the custom home, these requirements impact the cost of the ESS portion of the installation not the home iteself. The separation requirements were intentionaly matched to the existing private garage separaton requirements for correlation with constrction of he home. These requirments will increase the cost of installation of ESS.

RB154-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are concerns with much of the language. Regarding R327.3, installation, there is a reference to "living space," which does not include closets or corridors. Yet for acceptable locations they talk about storage closets. That is a conflict. For locations on the exterior, there are potential sensitivity issues with batteries, especially in hot and cold climates. In ventilation Section R327.3.5, they changed the section of the mechanical code which they referenced, which eliminates active natural ventilation. Regarding the references to temporary vehicles, it would be difficult for code officials to verify temporary vehicle use. Section R327.5 has problems in that the last referenced section does not exist. R327 talks about maintenance in the scoping, but there are no maintenance provisions. R327.4 talks about the potential to release toxic or highly toxic gasses. What is the difference? How does the code official verify that? Is that part of the UL listing? There are a lot of pieces that need work. (Vote: 10-1)

Assembly Action: **None**

RB154-19

Individual Consideration Agenda

Public Comment 1:

IRC®: SECTION R327, R327.1, R327.2, R327.3, R327.3.1 (New), R327.4 (New), R327.5 (New), R327.6, R327.7 (New), R327.8, R327.9, R327.10 (New)

Proponents:
Howard Hopper, representing UL LLC (howard.d.hopper@ul.com); Jeff Spies - Representing SEAC, Representing SEAC for this proposal. My employer is Planet Plan Sets, representing Sustainable Energy Action Committee (SEAC) (jeff.spies@planetplansets.com); Benjamin Davis, California Solar & Storage Association, representing California Solar & Storage Association (ben@calssa.org); Michael Schmeida, representing Gypsum Association (mschmeida@gypsum.org); Ed Kulik, representing ICC Building Code Action Committee (bcac@iccsafe.org); Matt Paiss, Pacific Northwest National Laboratory, representing International Association of Fire Fighters (matthew.paiss@pnnl.gov); Tim Earl, representing GBH International (tearl@gbhinternational.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

SECTION R327
ENERGY STORAGE ~~STATIONARY STORAGE BATTERY~~ SYSTEMS

R327.1 General. ~~*Stationary storage battery systems*~~ Energy storage systems (ESS) shall comply with the provisions of this section.

Exceptions:

1. ESS listed and labeled in accordance with UL 9540 and marked “For use in residential dwelling units”, where installed in accordance with the manufacturer’s instructions and NFPA 70.
2. ESS less than 1 kWh (3.6 megajoules).

R327.2 Equipment listings. ~~*Stationary storage battery systems*~~ ESS shall be listed and labeled ~~for residential use~~ in accordance with UL 9540.

~~Exceptions~~ Exception:

~~1.~~ Where *approved*, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.

~~2. Battery systems that are an integral part of an electric vehicle are allowed provided that the installation complies with Section 625.48 of NFPA 70.~~

3. ~~Battery systems less than 1 kWh (3.6 megajoules).~~

R327.3 Installation. ~~*Stationary storage battery systems*~~ ESS shall be installed in accordance with the manufacturer's instructions and their *listing*, ~~if applicable, and shall not be installed within the habitable space of a dwelling unit~~.

R327.3.1 Spacing Individual units shall be separated from each other by not less than three feet (914 mm) except where smaller separation distances are documented to be adequate based on large scale fire testing complying with Section 1206.1.5 of the *International Fire Code.*

R327.4 Locations. ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space in accordance with Section R302.6
3. Outdoors or on the exterior side of exterior walls located not less than 3 feet (914 mm) from doors and windows directly entering the dwelling unit.
4. Enclosed utility closets, basements, storage or utility spaces within dwelling units with finished or noncombustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than 5/8 inch Type X gypsum wallboard.

ESS shall not be installed in sleeping rooms, or closets or spaces opening directly into sleeping rooms.

R327.5 Energy ratings. Individual ESS units shall have a maximum rating of 20 kWh. The aggregate rating of the ESS shall not exceed:

1. 40 kWh within utility closets, basements, and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Sections 1206.1 through 1206.9 of the *International Fire Code.*

R327.6 ~~**R327.4**~~ **Electrical installation.** ~~*Stationary storage battery systems*~~ ESS shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

R327.7 Fire detection. Rooms and areas within dwellings units, basements, and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section R314. A heat detector, listed and interconnected to the smoke alarms, shall be installed in locations within dwelling units and attached garages where smoke alarms cannot be installed based on their listing.

R327.8 ~~**R327.6**~~ **Protection from impact.** ~~*Stationary storage battery systems*~~ ESS installed in a location subject to vehicle damage shall be protected by approved barriers.

R327.9 ~~**R327.5**~~ **Ventilation.** Indoor installations of ~~*stationary storage battery systems*~~ ESS that include batteries that produce hydrogen or other flammable gases during charging shall be provided with mechanical ventilation in accordance with Section M1307.4.

R327.10 Electric vehicle use. The temporary use of an owner or occupant's electric powered vehicle to power a dwelling unit while parked in an attached or detached garage or outdoors shall comply with the vehicle manufacturer's instructions and NFPA 70.

Commenter's Reason: At the committee action hearing several proponents provided testimony for different proposals to update the stationary storage battery provisions. The committee rightfully voted to disapproved all of the proposals until concerns with each were addressed. The one ESS proposal approved by the committee, F158-19, was solely an editorial change that changed reference from "stationary battery systems" to "energy storage systems" (ESS), to match IFC terminology.

Group A change F203-18 created a new section 1206.11 which covered ESS in Group R-3 and R-4 occupancies. Those requirements were also consistent with requirements in the new NFPA 855 energy storage system standard. Proposal RB154-19 included many of those requirements.

This public comment replaces the RB 154-18 proposal, and reflects what is believed to be a consensus of all proponents of the different ESS proposals. Comments on individual section are as follows:

R327.1 – This section includes the current 1 kWH threshold, and exempts a UL 9540 listed ESS that will not go into thermal runaway or produce flammable gas when subject to the UL 9540A Cell Level test. See proposal RB157-18.

R327.2 The equipment listing requirements are based on R327.2 in the 2018 IRC. The reference to "residential use" was removed since this is not a specific requirements in UL 9540, the standard used to list the equipment.

R327.3 Installation requirements are unchanged from the 2018 IRC (R327.3)

R327.3.1 Spacing between ESS are identical to spacing requirements in the 2021 IFC and NFPA 855, including an exception for decreasing spacings based on UL 9540A large scale fire testing.

R327.4 The locations where ESS are allowed is similar to the 2021 IFC and NFPA 855, with the following modifications:

- Item 3 corrected an oversight and allows ground mounted ESS to be installed adjacent to buildings on the property.
- Item 4 addressed concerns raised in proposals RB154, RB155, RB156, RB157 about ESS installations in utility closets, basements, storage or utility spaces.
- The last sentence clarifies that ESS is not allowed in sleeping rooms or closets or spaces opening directly into them.

R327.5 Energy ratings are identical to the values included in the in the 2021 IFC and NFPA 855. Allowing ESS with energy ratings above the values described to comply with ESS requirements for commercial systems (i.e. the IFC requirements) is allowed in NFPA 855.

R327.6 Electrical installation requirements are unchanged from the 2018 IRC. (R327.4)

R327.7 Fire detection includes the same requirements as the 2021 IFC and NFPA 855, with minor edits.

R327.8 Vehicle impact protection requirements are unchanged from the 2018 IRC. (R327.6)

R327.9 Ventilation requirements are based on R327.5 of the 2018 IRC. ESS utilizing battery technologies such as lithium-ion batteries do not require mechanical ventilation since they do not produce flammable gases during charging.

R327.10 Electric vehicle use is based on R327.2 (2) of the 2018 IRC, and the 2021 IFC and NFPA 855.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The new requirements have the potential to increase the cost of an ESS installation, but only if the homeowner chooses to have ESS installed.

Public Comment# 1519

RB156-19

IRC®: R327.3

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R327.3 Installation. *Stationary storage battery systems* shall be *listed* and installed in accordance with the manufacturer's instructions and their *listing*, ~~if applicable,~~ and shall ~~not~~ be installed ~~within the habitable space~~ only in the following locations of a dwelling unit.

1. In attached garages separated from the dwelling unit living and sleeping spaces in accordance with Section R302.6.
2. In detached garages.
3. In detached accessory structures.
4. Outdoors on exterior walls and located at a distance of not less than 3 ft. from doors and windows.

Reason: This revision corrects a problem with the existing code that allows the installation of ESS units in closets and other storage spaces without any special precautions, which is unsafe. The definition of habitable space in the IRC (A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.) specifically points out that closets and storage spaces are not habitable spaces. This revision also requires ESS units to be listed.

Cost Impact: The code change proposal will increase the cost of construction
This proposal may require special provisions for installation of ESS units.

RB156-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal is not evidence based. This proponents bans all storage battery technology because the proponent is uncomfortable with lithium ion. The hope is that the proponents work with the industry to create a public comment to create some room in the house where this type of equipment can be installed safely. (Vote: 9-2)

Assembly Action: **None**

RB156-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Submitted

Commenter's Reason: As stated in the original proposal, this revision corrects a problem with the existing code in that the IRC allows the installation of ESS units in closets and other storage spaces without any special precautions, which is unsafe. The definition of habitable space in the IRC (A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.) specifically points out that closets and storage spaces are not habitable spaces.
The potential fire hazard associated with ESS systems is not restricted to Lithium ion batteries.

This revision requires ESS units to be listed, which is consistent with other proposals and expected public comments.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This code proposal has the potential to require additional protection when installing ESS systems.

RB161-19

IRC®: R328 (New), R328.1 (New), R328.1.1 (New), R328.2 (New), R328.2.1 (New), R328.2.2 (New), R328.2.3 (New), R328.2.4 (New), R328.2.5 (New), R328.3 (New), R328.3.1 (New), R328.3.2 (New), R328.4 (New), R328.5 (New), R328.5.1 (New), R328.5.2 (New), R328.5.3 (New), R328.5.4 (New), R328.5.5 (New), R328.6 (New), ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, BRR Architecture, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com); David Allen, representing Edward Wayne Inc. (davidallen89@att.net); Ron Olberding, representing Edward Wayne Inc. (ronolberding@sbcglobal.net)

2018 International Residential Code

Add new text as follows:

R328
Physical Security

R328.1 Purpose. The purpose of this section is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

R328.1.1 Scope. The provisions of this section shall apply to all new structures and to additions and alterations made to existing buildings.

R328.2 Doors. All exterior swinging doors of residential dwelling units and attached garages, including doors leading from the garage area into the dwelling unit, shall comply with Sections R328.2.1 through R328.2.5 based on the type of door installed.

Exception: Vehicular access doors

R328.2.1 Wood doors. Exterior wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.

R328.2.2 Steel doors. Exterior steel doors shall be a minimum thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

R328.2.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

R328.2.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the doorframe, or by other approved methods.

R328.2.5 Sliding doors. Exterior sliding doors shall be installed to prevent the removal of the panels from the exterior.

R328.3 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Horizontal blocking shall be placed between studs at the door lock height for three stud spaces or equivalent bracing on each side of the door opening. Door frames shall comply with Sections R328.3.1 through R328.3.2 based on the type of door installed.

R328.3.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelights, shall be reinforced in accordance with ASTM F476 Grade 40 bolt and hinge impact only.

R328.3.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel and reinforced at the hinges and strikes. Doors are to be anchored to the wall in accordance with the manufacturer's instructions.

R328.4 Door jambs. Door jambs on wooden jambs for in-swinging doors shall be of one-piece construction.

R328.5 Door hardware. Exterior door hardware shall comply with Sections R328.5.1 through R328.5.5.

R328.5.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure shall be used. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

R328.5.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge.

R328.5.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade 2 as determined by ANSI/BHMA.

R328.5.4 Entry vision and glazing. All main or front entry doors to dwelling units shall be arranged so that the occupant has a view of the area immediately outside the door without opening the door. The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.

R328.5.5 **Side light entry doors.** Side light doors units shall have framing of double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2. The door frame that separates the door opening from the side light, whether on the latch side or the hinge side, shall be double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2. Double stud construction or equivalent construction shall exist between the glazing unit of the side light and the wall structure of the dwelling.

R328.6 **Alternate materials and methods of construction.** The provisions of this section are not intended to prevent the use of any material or method of construction not specifically prescribed by this section, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this section. The materials, method of construction and structural design limitations provided for in this section shall be used, unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this section.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476 - 14: **Standard Test Methods for Security of Swinging Door Assemblies**

Reason: In the summer of 1996, Overland Park, Kansas, experienced a series of home invasions resulting in the sexual assault of several women. For the victims of a home invasion, it's more than a property crime; it scares the victim into thinking that the criminal will return only to commit a more violent or heinous crime. To have an emotional investment in their residence is priceless.
As a result of these home invasions, the City's Police Department conducted hundreds of surveys of residents in an effort to develop a solution to the home invasions. The results of the surveys lead the City to develop a building code that makes home more safe and secure. You may ask, why secure the front door? What about installing an alarm? Communities across the country continue to report a growing increase in false alarms. In an effort to provide physical security to the homeowner, there needs to be a more reliable option available.

The longer a criminal spends trying to gain access to a home, the greater the risk of detection. In addition, most home invaders will not attempt to break a window, as that makes noise that neighbors could potentially hear. Rather than face these risks, the invader is more likely to try to kick in an exterior door, where they can easily gain access without being detected.

This code change will provide for minimal provisions to be made to a new home under construction that will give the homeowner safety and peace of mind, while delaying and frustrating the criminal. Since this proposal is not dependent on electrical power, these provisions will always be available to the homeowner and will require no further action after installation. There is no on-going cost to the homeowner and these provisions will not affect the overall aesthetics of the home.

Cost Impact: The code change proposal will increase the cost of construction
The cost to secure a single door ranges from $40-$60 for a single door unit and between $140 and $180 for a double sidelite unit.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F476 and ANSI/BHMA, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB161-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: The committee applauds the proponents time and effort. But this goes well beyond the minimum. It should be an appendix chapter. This is outside the scope of the IRC. The building codes are not crime prevention codes. There are opening requirements and people sometimes like to have their windows open a night. If they are not home, people go through the window if they can't go through the front door. There may be a false sense of security. R328.1 is commentary. There should not be a separate scope for an individual section. The language regarding fiberglass doors is vague. These are best practices and do not belong in the codes. This is probably more suited to urban environments and may not be appropriate for all areas of the country. (Vote: 10-1)

Assembly Action: None

RB161-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R328 (New), R328.1 (New), R328.1.1 (New), R328.2 (New), R328.2.1 (New), R328.2.2 (New), R328.2.3 (New), R328.2.4 (New), R328.2.5 (New), R328.3 (New), R328.3.1 (New), R328.3.2 (New), R328.3.3 (New), R328.4 (New), R328.4.1 (New), R328.4.2 (New), R328.5.3 (New), R328.4.4 (New), R328.6 (New), ANSI Chapter 44 (New), ASTM Chapter 44 (New)

Proponents:
Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com); David Allen, Edward Wayne Inc., representing Edward Wayne (davidallen89@att.net); Ron Olberding, representing Edward Wayne (ronolberding@sbcglobal.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R328
Physical Security

R328.1 Purpose. The purpose of this section is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

R328.1.1 ~~Scope~~ Application. The provisions of this section shall apply to all new structures and to additions and alterations made to existing buildings as provided for in Section R102.7.1.

R328.2 Doors. All exterior ~~swinging~~ doors , ~~of residential dwelling units and attached garages, including~~ and doors leading from the garage area into the dwelling unit, shall comply with Sections R328.2.1 through R328.2.5 based on the type of door installed.

~~Exception~~ Exceptions:

1. Vehicle access doors
2. Storm or screen doors

R328.2.1 Wood doors. ~~Exterior w~~ Wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) where measured at the locking device or hinge. ~~at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.~~

R328.2.2 Steel doors. ~~Exterior s~~ Steel doors shall be a minimum skin thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

R328.2.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

R328.2.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the doorframe, or by other approved methods.

R328.2.5 Sliding doors. ~~Exterior s~~ Sliding doors shall be installed to prevent the removal of the panels from the exterior.

R328.3 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Two-inch nominal wood ~~Horizontal~~ blocking shall be placed horizontally between studs at the door lock height for ~~three~~ one stud spac~~es or equivalent bracing~~ on each side of the door opening. Door frames shall comply with ASTM F476 Grade 40 for the bolt and hinge impact tests. Door frames shall comply with Sections R328.3.1 through ~~R328.3.2~~ R328.3.3 based on the type of door installed.

R328.3.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelite~~lights~~, shall be reinforced ~~in accordance with ASTM F476 Grade 40 bolt and hinge impact only~~.

R328.3.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel ~~and reinforced at the hinges and strikes~~. Doors ~~are to~~ shall be anchored to the wall in accordance with the manufacturer's instructions.

~~R328.5.5~~ R328.3.3 Sidelite ~~light~~ entries ~~entry doors~~. Sidelite ~~light~~ door~~s~~ units shall have framing of double stud construction or equivalent construction ~~complying with Sections R328.3.1 or R328.3.2. The door frame that separates the door opening from the side light, whether on the latch side or the hinge side, shall be double stud construction or equivalent construction complying with Sections R328.3.1 or R328.3.2.~~ Double stud construction or equivalent construction shall exist between the glazing unit of the sidelite ~~side light~~ and the wall structure of the dwelling.

~~**R328.4 Door jambs.** Door jambs on wooden jambs for in-swinging doors shall be of one-piece construction.~~

R328.4 ~~R328.5~~ Door hardware. Exterior door hardware shall comply with Sections R328.4.1 ~~R328.5.1~~ through R328.4.4 ~~R318.5.5~~.

~~R328.5.1~~ R328.4.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure ~~shall be used~~. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

Exception: Sidelite doors complying with ASTM F476 for the bolt and hinge impact tests.

~~R328.5.2~~ R328.4.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge at the location of the deadbolt.

R328.5.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade ~~2~~ B as determined by ANSI/BHMA A156.40.

~~R328.5.4~~ R328.4.4 Entry vision and glazing. ~~All main or f~~ Front entry doors to dwelling units shall be arranged so that the occupant has a 180 degree view of the area immediately outside the door without opening the door. ~~The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.~~

~~**R328.6 Alternate materials and methods of construction.** The provisions of this section are not intended to prevent the use of any material or method of construction not specifically prescribed by this section, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this section. The materials, method of construction and structural design limitations provided for in this section shall be used, unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this section.~~

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York NY 10036

A156.40: American National Standard for Residential Deadbolts

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476 - 14: Standard Test Methods for Security of Swinging Door Assemblies

Commenter's Reason: One of the concerns the committee expressed was that this code change goes beyond the minimum requirements of the IRC. Per Section R101.3, the purpose of the IRC is to safeguard the public safety in general as well as for safety to life and property from fire and other hazards attributed to the built environment. How is protecting the occupants of a home from unwanted physical entry not providing a minimum level of protection for the public safety?

Another concern expressed by the committee was that the building code is not a crime prevention code. We agree with the committee. However, the code does address life safety, which is what we believe this code change covers.

One of the committee members expressed concerns about window opening requirements and that someone wanting entry would enter through the window. This code change is not about windows so we're not sure what the committee's concern was regarding windows. The FBI Uniform Crime Report shows that the majority of break-ins occur through an exterior door, which is what this code change is addressing.

Another committee comment was that this language is commentary. This code change includes code language, so we're not sure what the committee meant by that as commentary is generally language defining the code requirements.

In regards to the statement made by the committee about a false sense of security, current construction practices technically give a false sense of security as there are no requirements for any sense of security to a home owner in the current IRC. If someone wants to break into a home, they will find a way to do so. Much like a smoke detector provides the homeowner ample time to respond to a possible fire, this code change is an attempt to provide the homeowner ample time to respond to an attempted break-in.

What helps to prevent crime is witness potential. By delaying the potential entry into a home, the probability of a witness increases. Whether you live in a rural or urban environment, this code change provides the homeowner ample time to respond.

We believe that we have addressed concerns expressed by not only the committee but others who spoke in opposition with the language presented in this public comment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost to secure a single door ranges from $40-60 for a single door unit and between $140-180 for a double side light unit.

Public Comment# 1385

RB162-19

IRC®: 202 (New), R328.1 (New), R328.2, R328.3, ASTM Chapter 44 (New), SECTION, AO101.1, SECTION AO102, 202, SECTION AO103, AO103.1, AO103.2, SECTION AO104

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)

2018 International Residential Code

Add new definition as follows:

VEHICULAR GATE. A moveable barrier that is intended for use at a vehicle entrance or exit and not intended for use by pedestrian traffic.

Add new text as follows:

R328.1 General. Where provided, automatic vehicular gates shall comply with the requirements of Sections R328.2 and R328.3.

R328.2 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

R328.3 Vehicular gate openers. Vehicular gate openers shall be listed in accordance with UL 325.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F2200-14: Standard Specification for Automated Vehicular Gate Construction

Delete without substitution:

~~SECTION AO101~~
~~GENERAL~~

~~**AO101.1 General.** The provisions of this appendix shall control the design and construction of automatic vehicular gates installed on the lot of a one- or two-family dwelling.~~

~~SECTION AO102~~
~~DEFINITION~~

~~**VEHICULAR GATE.** A gate that is intended for use at a vehicular entrance or exit to the lot of a one- or two-family dwelling, and that is not intended for use by pedestrian traffic.~~

~~SECTION AO103~~
~~AUTOMATIC VEHICULAR GATES~~

~~**AO103.1 Vehicular gates intended for automation.** Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.~~

~~**AO103.2 Vehicular gate openers.** Vehicular gate openers, where provided, shall be listed in accordance with UL 325.~~

~~**SECTION AO104 REFERENCED STANDARDS**~~

~~ASTM F2200—14~~	~~Standard Specification for Automated Vehicular Gate Construction~~	~~AO103.1~~
~~UL 325—02~~	~~Door, Drapery, Gate, Louver and Window Operations and Systems—with revisions through May 2015~~	~~AO103.2~~

Reason: This proposal recognizes the importance of safety by moving the requirements for automatic vehicular gates from Appendix O to the body of the code. It does not require the use of automated vehicular gates, but where vehicular gates are provided, it requires them to meet the same safety standards that are in the IBC (Section 3110) and the IFC (Sections 503.5 and 503.6.).
In 2018, CPSC launched “Operation Safe Gate” to put an end to preventable tragedies caused by automatic security gates. CPSC estimates that there are about 300 emergency room injuries each year due to automatic gates. Many of the injuries have been serious and resulted in cuts, broken bones, hematomas and amputations. In addition, CPSC has received four tragic reports of fatalities in recent years, including an 8 year old, an 11 year old and a 12 year old.

https://onsafety.cpsc.gov/blog/2018/08/06/operation-safe-gate-put-an-end-to-automatic-security-gate-tragedies/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not require vehicular gates to be installed. There are numerous automated vehicular gates that already comply with these safety standards, so when these are used there will be no increase in costs.

Staff Analysis: The referenced standard, ASTM F2200, is currently referenced in other 2018 I-codes.

RB162-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal creates two sections that deal with additions and alterations. Existing Section R102.7.1 must be addressed to make this proposal work. This should be addressed by public comment. The modifications were improvements, but they were not enough. This does not belong in the body of the IRC. (Vote: 7-3)

Assembly Action: **None**

RB162-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 202 (New), R309.4, R328 (New), R328.1 (New), R328.2, R328.3, APPENDIX O, ASTM Chapter 44 (New), UL Chapter 44

Proponents:
Jonathan Roberts, representing UL LLC (jonathan.roberts@ul.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

VEHICULAR GATE.
A moveable barrier, other than a garage door, that is intended for use at a vehicle entrance or exit and ~~not intended for use~~ primarily used by ~~pedestrian~~ vehicular traffic.

R309.4 Automatic garage door openers and automatic vehicular gates. Automatic garage door openers, if provided, shall be *listed* and *labeled* in accordance with UL 325. Automatic vehicular gates, if provided, shall comply with Section 328.

R328
Automatic Vehicular Gates

R328.1 General. Where provided, automatic *vehicular gates* shall comply with the requirements of Sections R328.2 and R328.3.

R328.2 Vehicular gates intended for automation. *Vehicular gates* intended for automation shall be designed, constructed, and installed to comply with the requirements of ASTM F2200.

R328.3 Vehicular gate openers. *Vehicular gate* openers shall be *listed* in accordance with UL 325.

~~APPENDIX O~~
~~AUTOMATIC VEHICULAR GATES~~ ***(Entire appendix to be deleted)***

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F2200-14: Standard Specification for Automated Vehicular Gate Construction

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062

325—02: Door, Drapery, Gate, Louver and Window Operators and Systems—with revisions through May 2015

Commenter's Reason: As part of this public comment the following editorial changes have been made:

- Language has been added to the definition to differentiate a garage door from a vehicular gate.
- Automatic vehicular gates have been added to R309.4, as a pointer to new Section 328.
- The Section 328 heading has been added.
- The Section 328 reference has been added to ASTM F2200 under Reference Standards.
- The Section 309 and Section 328 references have been added to UL 325 under Reference Standards.
- The UL 325 title has been revised.

We have also attempted to address the comments brought forth by the Committee and the NAHB as follows:

1. Removal of one- and two-family dwellings from the definition makes the application too broad.

   - It is our understanding that the scope of the IRC is applicable and pertains to these types devices. Examples of this would include lots containing lodging houses and townhouses, which can use automated vehicular gates, as well as the lots of one- and two-family dwellings.

2. Although vehicular access gates are used primarily for vehicles, they can act as pedestrian access in residential applications.

   - Although UL 325 and the gate operator installation instructions call for a separate pedestrian entrance to be installed, pedestrians may pass through the gate opening on residential properties. Thus, it becomes especially important to have a UL 325 and ASTM F2200 compliant gate to protect individual from becoming trapped between a moving gate and any fixed object.

3. The CPSC injury data shows no residential-based events.

   - The CPSC will not use this as a basis for residential installations to not comply with UL 325 and ASTM F2200. The same risks affect those installations as they do non-residential installations.

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 require vehicular gates to be installed. There are numerous automated vehicular gates that already comply with these safety standards, so when these are used there will be no increase in costs.

Public Comment# 1405

RB163-19

IRC®: SECTION R328 (New), R328.1 (New), R328.2 (New), R328.3 (New)

Proposed Change as Submitted

Proponents: Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

2018 International Residential Code

Add new text as follows:

SECTION R328
ALTERATIONS AND ADDITIONS

R328.1 General. *Addition*s and *Alterations* to detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane in height, shall comply with this code or the *International Existing Building Code.* Where the alteration includes a change of use or occupancy to one not within the scope of the *International Residential Code*, the alteration shall comply with the *International Existing Building Code.*

R328.2 Additions. *Additions* to buildings within the scope of the *International Residential Code* shall comply with the requirements of the International Residential Code for new construction. *Alterations* to the existing building or structure shall be such that the existing building or structure together with the addition is not less compliant with the provisions of the *International Residential Code* than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height limits of the *International Residential Code.*

R328.3 Alterations. *Alterations* to any building or structure within the scope of the *International Residential Code* shall comply with the requirements of the *International Residential Code* for new construction. *Alteration*s shall be such that the existing building or structure is not less compliant with the provisions of the *International Residential Code* than the existing building or structure was prior to the *alteration.*

Reason: This proposed code change is editorial in nature and cross reference the IEBC in similar fashion to the way the IEBC provides the IRC as an option for compliance in the exception to Secttion 101.2. The code change also fills a gap regarding addtions and alterations since the two scopes of work that are defined in Chapter 2 are only used within specific sections such as smoke alarm and carbon monoxide alarm requirements for example. The proposed genral text is extracted from the IEBC prescriptive method sections in chapter 5. The alterations section also calrifies that you only need to go to the IEBC if the alteration changes the occuapancy or use to one not regulated by the IRC.
Chapter 3 was selected in lieu of chapter 1 since some jurisdictions may not adopt Chapter 1 of the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed code change is editorial in nature and does not add new standards.

RB163-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this. (Vote: 10-1)

Assembly Action: **None**

RB163-19

Individual Consideration Agenda

Public Comment 1:

IRC®: SECTION R328 (New), R328.1 (New), R328.2 (New), R328.3 (New), R328.4 (New), R328.5 (New)

Proponents:
David Bonowitz, representing Self (dbonowitz@att.net)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

SECTION R328 EXISTING STRUCTURAL ELEMENTS

R328.1 **General.** Additions, alterations or repairs to any building shall conform to the requirements for a new building without requiring the existing structural elements to comply with the requirements of this code, unless otherwise stated. Additions, alterations, repairs and relocations shall not cause an existing structure to become dangerous. Buildings located in flood hazard areas shall comply with Section R105.3.1.1.

R328.2 **Additions.** Where an addition would not be structurally independent, the existing structure and the addition considered together shall be no less compliant with the structural provisions of this code than the existing structure prior to the addition. An existing structure together with its additions shall comply with the height limits of this code.

R328.3 **Alterations.** An altered structure shall be no less compliant with the structural provisions of this code than the existing structure prior to the alteration.

R328.4 **Repairs.** A repaired structure shall be no less compliant with the structural provisions of this code than the existing structure prior to the damage being repaired.

R328.5 **Change of use or occupancy.** A change of use or occupancy to one not within the scope of this code shall comply with the *International Existing Building Code*.

Commenter's Reason: In disapproving RB163, the IRC committee invited a modification by public comment. The committee's reason, in its entirety, said, "This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this."
The "existing text" referenced by the committee is in IRC Section R102.7.1. That section refers to whole buildings and structures. This PC eliminates any duplication by referring only to existing structural elements -- in exactly the same way that current Sections N1107 through N1111 address existing conditions with regard to energy efficiency, Section M1202 addresses existing mechanical systems, and Section P2502 addresses existing plumbing systems.

The PC also makes a number of clarifications, simplifications, and minor corrections to the original RB163 text, but otherwise it shares the same reasoning: With the approval last cycle of IEBC Section 101.2 and the disapproval this cycle of proposal ADM7-19, ICC committees are confirming their intent that the IRC should be a code for existing dwellings and townhouses as well as new ones. To fulfill that purpose, the IRC needs some provisions to cover existing structural elements. Further, those provisions need to be more than a general statement in Chapter 1. The IRC should have a section for existing structural elements in Chapter 3, just as it has Sections N1107-N111, M1202, and P2502 for energy efficiency, mechanical systems, and plumbing systems respectively.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As with the original proposal RB163, this version modified by public comment merely clarifies what we believe is the current intent of the code.

Public Comment# 2146

Public Comment 2:

IRC®: R102.7.1

Proponents:
Ali Fattah, City of San Diego, representing City of San Diego (afattah@sandiego.gov)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R102.7.1 Additions, alterations or repairs. *Additions*, *alterations* or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with the requirements of this code, unless otherwise stated. *Additions*, *alterations,* repairs and relocations shall not cause an existing structure to become ~~unsafe or adversely affect the performance of the building.~~ less compliant with the provisions of this code than the existing building or structure was prior to the addition, alteration or repair. An existing building together with its additions shall comply with the height limits of this code. Where the alteration causes the use or occupancy to be changed to one not within the scope of this code, the provisions of the International Existing Building Code shall apply.

Commenter's Reason: The original code change was proposed in chapter 3 and is completely replaced with a simpler proposal in chapter 1 or the IRC and more specifically Section R102.7.1. It also only references the IEBC when the occupancy changes to one not regulated by the IRC. We believe that the public comment addressed all the issues raised in the CAH.

- With recent changes to the IEBC (Sec 101.2) , all existing dwellings and townhouses are now eligible to use the IRC for any existing building project, but the only EB structural provisions in the IRC are in the Admin chapter (R102.7.1).
- If the IRC is now also going to function as an EB code, it needs some provisions for existing structural elements, just as it has provisions energy efficiency in existing buildings (Ch 11) and for existing mechanical systems (Ch 12), existing plumbing systems (Ch 25), and existing chimneys (Sec G2427.5.5).
- This proposal, as modified by public comment, updates Section 102.7.1. The proposed text does not change any of the intent of current Section R102.7.1, but it separates and clarifies that intent by project type.
- The public comment also simplifies and corrects some of the original proposal wording.

The committee's reason for initial disapproval, in its entirety, was as follows (referencing Section R102.7.1): "This proposal adds language that duplicates existing text. Please come back with a public comment that addresses this. (Vote: 10-1)". But a review of the existing text in Section R102.7.1 shows that the proposal did not duplicate text in any way that creates a conflict. Nevertheless the committee's wishes have been fulfilled with this replacement.

Prior to the proposed modification to R102.7.1, the Section already says "unless otherwise stated," acknowledging that other provisions can be added without modifying or contradicting that section.

The proponent requests approval by way of public comment # 1, we require 2/3 of the voting majority for the online governmental vote to pass this code change please vote in support of this public comment.

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 correlates the IRC with the IEBC, does not make technical changes, and thus does not increase or decrease construction costs.

Public Comment# 1316

RB164-19

IRC®: TABLE R403.1(1), TABLE R403.1(2), TABLE R403.1(3), R403.1.1

Proposed Change as Submitted

Proponents: Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

Revise as follows:

TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]

Portions of table not shown remain unchanged.

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	12 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	16~~18~~ 6	12~~14~~ 6	12 6	12 6	12 6	12 6
	2 storyslab-on-grade	13~~12~~ 6	12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	15~~16~~ 6	12 6	12 6	12 6	12 6	12 6
	2 storyplus basement	19~~22~~ 6	14~~16~~ 6	12~~13~~ 6	12 6	12 6	12 6
	3 storyslab-on-grade	16~~14~~ 6	12 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	18 x 6~~19 6~~	14 6	12 6	12 6	12 6	12 6
	3 storyplus basement	22 x 7~~25 8~~	16~~19~~ 6	13~~15~~ 6	12~~13~~ 6	12 6	12 6
30 psf	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	13 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	16~~19~~ 6	12~~14~~ 6	12 6	12 6	12 6	12 6
	2 storyslab-on-grade	13~~12~~ 6	12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	16~~17~~ 6	12~~13~~ 6	12 6	12 6	12 6	12 6
	2 storyplus basement	19~~23~~ 6	14~~17~~ 6	12~~14~~ 6	12 6	12 6	12 6
	3 storyslab-on-grade	16~~15~~ 6	14~~12~~ 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	19 x ~~20~~ 6	14~~15~~ 6	12 6	12 6	12 6	12 6
	3 storyplus basement	22 x 7~~26 8~~	16~~20~~ 6	13~~16~~ 6	12~~13~~ 6	12 6	12 6
50 psf	1 storyslab-on-grade	12 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	14~~16~~ 6	12 6	12 6	12 6	12 6	12 6
	1 storyplus basement	18~~21~~ 6	13~~16~~ 6	12~~13~~ 6	12 6	12 6	12 6
	2 storyslab-on-grade	15~~14~~ 6	13~~12~~ 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	17~~19~~ 6	13~~14~~ 6	12 6	12 6	12 6	12 6
	2 storyplus basement	21~~25~~ 7	15~~19~~ 6	12~~15~~ 6	12 6	12 6	12 6
	3 storyslab-on-grade	18~~17~~ 6	13 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	20~~22~~ 6	15~~17~~ 6	12~~13~~ 6	12 6	12 6	12 6
	3 storyplus basement	24 x 8~~28 9~~	18~~21~~ 6	14~~17~~ 6	12~~14~~ 6	12 6	12 6
	1 storyslab-on-grade	14~~12~~ 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	16~~18~~ 6	12~~13~~ 6	12 6	12 6	12 6	12 6
	1 storyplus basement	19 x 6~~24 7~~	14~~18~~	12~~14~~	12 6	12 6	12 6

			6	6			
70 psf	2 storyslab-on-grade	17~~16~~ 6	12 6	12 6	12 6	12 6	12 6
	2 storywith crawl space	19~~21~~ 6	14~~16~~ 6	12~~13~~ 6	12 6	12 6	12 6
	2 storyplus basement	22 x 7~~27 9~~	17~~20~~ 6	13~~16~~ 6	12~~14~~ 6	12 6	12 6
	3 storyslab-on-grade	20 x 6~~19 6~~	15~~14~~ 6	12 6	12 6	12 6	12 6
	3 storywith crawl space	22~~25~~ 7	16~~18~~ 6	13~~15~~ 6	12 6	12 6	12 6
	3 storyplus basement	24 x 8~~30 10~~	19~~23~~ 6	15~~18~~ 6	13~~15~~ 6	12~~13~~ 6	12 6

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m^2.

a.~~Interpolation allowed.~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not~~allowed.~~ permitted.

b.~~Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).~~ The table is based on the following conditions and loads: Building width: 32 feet; Wall height: 9 feet; Basement wall height: 8 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; Live loads: Roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.

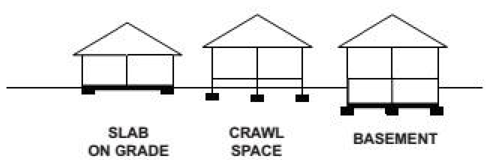


TABLE R403.1(2)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION WITH BRICK VENEER OR LATH AND PLASTER (inches)[a, b, c, d]

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH BRICK VENEER	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18~~21~~ × 6	14~~15~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	18~~15~~ × 6	13~~12~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	23~~26~~ × 8	17~~20~~ × 6	14~~16~~ × 6	12~~13~~ × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 x 8~~20 × 6~~	17~~15~~ × 6	14~~12~~ × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	25 x 9~~26 × 8~~	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	29~~32 × 11~~	21~~24~~ × 7	17~~19~~ × 6	14~~16~~ × 6	12~~14~~ × 6	12 × 6
30 psf	1 story—slab-on-grade	13~~12~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	15~~16~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18~~22~~ × 6	14~~16~~ × 6	12~~13~~ × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	18~~16~~ × 6	14~~12~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	20~~22~~ × 6	15~~16~~ × 6	12~~13~~ × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	24 x 8~~27 × 9~~	18~~21~~ × 6	14~~16~~ × 6	12~~14~~ × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 x 8~~21 × 6~~	18~~16~~ × 6	14~~13~~ × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	26 x 9~~27 × 8~~	19~~20~~ × 6	15~~16~~ × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	29~~33~~ × 11	22~~24~~ × 7	17~~20~~ × 6	14~~16~~ × 6	12~~14~~ × 6	12 × 6
50 psf	1 story—slab-on-grade	14~~13~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	17~~18~~ × 6	13~~14~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	20 x 6~~24 × 7~~	15~~18~~ × 6	12~~14~~ × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	20~~18~~ × 6	15~~14~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	22~~24~~ × 7	17~~18~~ × 6	13~~14~~ × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	25 x 9~~29 × 10~~	19~~22~~ × 6	15~~18~~ × 6	13~~15~~ × 6	12~~13~~ × 6	12 × 6
	3 story—slab-on-grade	25 x 9~~27 × 7~~	19 x 6~~18 × 6~~	15~~13~~ × 6	13~~12~~ × 6	12 × 6	12 × 6
	3 story—with crawl space	27 x 10~~29 × 9~~	21 x 7~~22 × 6~~	16~~17~~ × 6	14 × 6	12 × 6	12 × 6
	3 story—plus basement	31~~35~~ × 12	23~~26~~ × 8	18~~21~~ × 6	15~~17~~ × 6	13~~15~~ × 6	12~~13~~ × 6
	1 story—slab-on-grade	14~~15~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	17~~20~~ × 6	14~~15~~ × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	22 x 7~~26 ×~~	16~~20~~ × 6	13~~16~~ ×	12~~13~~ ×	12 × 6	12 × 6

		8	—	6	6		
70 psf	2 story—slab-on grade	21 x 720 × 6	1615 × 6	1312 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	2426 × 8	1819 × 6	1415 × 6	1213 × 6	12 × 6	12 × 6
	2 story—plus basement	27 x 1032 × 11	20 x 624 × 7	1619 × 6	1316 × 6	1214 × 6	12 × 6
	3 story—slab-on-grade	27 x 1026 × 8	2019 × 6	1615 × 6	13 × 6	12 × 6	12 × 6
	3 story—with crawl space	2931 × 11	2223 × 7	1719 × 6	1516 × 6	1213 × 6	12 × 6
	3 story—plus basement	32 x 1237 × 13	24 x 828 × 9	1922 × 6	1618 × 6	1416 × 6	1214 × 6

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m^2.

a. Interpolation allowed. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not allowed. permitted.

b. Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick). The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 45 psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor; 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.

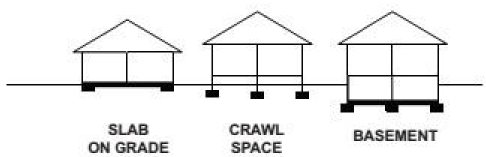


TABLE R403.1(3)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR ~~FULLY~~ PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)[a, b, c, d]

~~GROUND~~ SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH CMU OR CONCRETE	LOAD-BEARING VALUE OF SOIL (psf)					
		1500	2000	2500	3000	3500	4000
20 psf roof live load or 25 psf ground snow load	1 storyslab-on-grade	13~~14~~ 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	16~~19~~ 6	12~~14~~ 6	12 6	12 6	12 6	12 6
	1 storyplus basement	19 x 6~~25~~ ~~8~~	14~~19~~ 6	12~~15~~ 6	12~~13~~ 6	12 6	12 6
	2 storyslab-on-grade	19 x 6~~23~~ 7	14~~18~~ 6	12~~14~~ 6	12 6	12 6	12 6
	2 storywith crawl space	22 x 7~~29~~ ~~9~~	16~~22~~ 6	13~~17~~ 6	12~~14~~ 6	12 6	12 6
	2 storyplus basement	25 x 9~~35~~ ~~12~~	19 x 6~~26~~ ~~8~~	15~~21~~ 6	12~~17~~ 6	12~~15~~ 6	12~~13~~ 6
	3 storyslab-on-grade	25 x 9~~32~~ ~~11~~	19 x 6~~24~~ ~~7~~	15~~19~~ 6	13~~16~~ 6	12~~14~~ 6	12 6
	3 storywith crawl space	28 x 10~~38~~ ~~14~~	21 x 7~~28~~ ~~9~~	17~~23~~ 6	14~~19~~ 6	12~~16~~ 6	12~~14~~ 6
	3 storyplus basement	31 x 12~~43~~ ~~17~~	23 x 8~~33~~ ~~11~~	18 x 6~~26~~ ~~8~~	15~~22~~ 6	13~~19~~ 6	12~~16~~ 6
30 psf	1 storyslab-on-grade	13~~15~~ 6	12 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	16~~20~~ 6	12~~15~~ 6	12 6	12 6	12 6	12 6
	1 storyplus basement	19 x 7~~26~~ ~~8~~	14~~20~~ 6	12~~16~~ 6	12~~13~~ 6	12 6	12 6
	2 storyslab-on-grade	19 x 6~~24~~ ~~7~~	15~~18~~ 6	12~~15~~ 6	12 6	12 6	12 6
	2 storywith crawl space	22 x 7~~30~~ ~~10~~	16~~22~~ 6	13~~18~~ 6	12~~15~~ 6	12~~13~~ 6	12 6
	2 storyplus basement	25 x 9~~36~~ ~~13~~	19 x 6~~27~~ ~~8~~	15~~21~~ 6	13~~18~~ 6	12~~15~~ 6	12~~13~~ 6
	3 storyslab-on-grade	26 x 9~~33~~ ~~12~~	19 x 6~~25~~ ~~7~~	15~~20~~ 6	13~~17~~ 6	12~~14~~ 6	12 6
	3 storywith crawl space	28 x 10~~39~~ ~~14~~	21 x 7~~29~~ ~~9~~	17 x 6~~23~~ ~~7~~	14~~19~~ 6	12~~17~~ 6	12~~14~~ 6
	3 storyplus basement	31 x 12~~44~~ ~~17~~	23 x 8~~33~~ ~~12~~	19 x 6~~27~~ ~~8~~	16~~22~~ 6	13~~19~~ 6	12~~17~~ 6
50 psf	1 storyslab-on-grade	15~~17~~ 6	12~~13~~ 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	18~~22~~ 6	13~~17~~ 6	12~~13~~ 6	12 6	12 6	12 6
	1 storyplus basement	21 x 7~~28~~ ~~9~~	16~~21~~ 6	12~~17~~ 6	12~~14~~ 6	12 6	12 6
	2 storyslab-on-grade	21 x 7~~27~~ ~~8~~	16~~20~~ 6	13~~16~~ 6	12~~13~~ 6	12 6	12 6
	2 storywith crawl space	24 x 8~~32~~ ~~11~~	18 x 6~~24~~ ~~7~~	14~~19~~ 6	12~~16~~ 6	12~~14~~ 6	12 6
	2 storyplus basement	27 x 10~~38~~ ~~14~~	20 x 6~~28~~ ~~9~~	16~~23~~ 6	13~~19~~ 6	12~~16~~ 6	12~~14~~ 6
	3 storyslab-on-grade	27 x 10~~35~~ ~~13~~	20 x 6~~27~~ ~~8~~	16~~21~~ 6	14~~18~~ 6	12~~15~~ 6	12~~13~~ 6
	3 storywith crawl space	30 x 11~~41~~ ~~15~~	22 x 7~~31~~ ~~10~~	18 x 6~~24~~ ~~7~~	15~~20~~ 6	13~~17~~ 6	12~~15~~ 6
	3 storyplus basement	33 x 13~~47~~	25 x 9~~35~~	20 x 6~~28~~	16 x	14~~20~~	12~~17~~

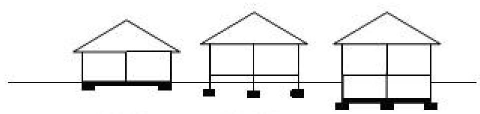
		~~18~~	~~12~~	~~9~~	6~~23 7~~	6	6
70 psf	1 storyslab-on-grade	17~~19~~ 6	13~~14~~ 6	12 6	12 6	12 6	12 6
	1 storywith crawl space	19 x 6~~25~~ ~~7~~	14~~18~~ 6	12~~15~~ 6	12 6	12 6	12 6
	1 storyplus basement	22 x 7~~30~~ ~~10~~	17~~23~~ 6	13~~18~~ 6	12~~15~~ 6	12~~13~~ 6	12 6
	2 storyslab-on-grade	23 x 8~~29~~ ~~9~~	17~~22~~ 6	14~~17~~ 6	12~~14~~ 6	12 6	12 6
	2 storywith crawl space	25 x 9~~34~~ ~~12~~	19 x 6~~26~~ ~~8~~	15~~21~~ 6	12~~17~~ 6	12~~15~~ 6	12~~13~~ 6
	2 storyplus basement	28 x 10~~40~~ ~~15~~	21 x 7~~30~~ ~~10~~	17 x 6~~24~~ ~~7~~	1420 6	12~~17~~ 6	12~~15~~ 6
	3 storyslab-on-grade	29 x 11~~38~~ ~~14~~	22 x 7~~28~~ ~~9~~	17~~23~~ 6	14~~19~~ 6	12~~16~~ 6	12~~14~~ 6
	3 storywith crawl space	31 x 12~~43~~ ~~16~~	23 x 8~~32~~ ~~11~~	19 x 6~~26~~ ~~8~~	16~~21~~ 6	13~~18~~ 6	12~~16~~ 6
	3 storyplus basement	34 x 13~~49~~ ~~19~~	26 x 9~~37~~ ~~13~~	21 x 7~~29~~ ~~10~~	17 x 6~~24 7~~	15~~21~~ 6	13~~18~~ 6

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m^2.

a.~~Interpolation allowed.~~ Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not~~allowed.~~ permitted.

b.~~Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).~~ The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 10 psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width.



R403.1.1 Minimum size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3, as applicable but not less than 12 inches (305 mm) in width and 6 inches (152 mm) in depth. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3). Footings for precast foundations shall be in accordance with the details set forth in Section R403.4, Table R403.4, and Figures R403.4(1) and R403.4(2).

Reason: Builders using the new footing tables introduced in the 2015 IRC have found the footing widths required by the table are significantly larger than those required by previous editions of Table R403.1, which dated back to the CABO codes. In many cases they were wider than an engineering analysis would suggest. A careful review of the calculations underlying the 2015 IRC tables found a number of cases where load assumptions and determinations were overly conservative, and a few cases where the calculations were actually unconservative. Problems with the assumptions and calculations included the following:

- The original calculations apply the full ground snow load to the roof. The actual roof snow load per ASCE 7, unadjusted by any other factors, is 70% of the ground snow load or 20 pounds per square foot, whichever is greater. Consistent with the Chapter 8 rafter tables, a thermal factor of 1.1 per ASCE 7 is applied to the calculation of the snow load.

- The original calculations apply a 100 pound per square foot weight for above-grade concrete or masonry walls, representing a solid or fully-grouted 8" CMU wall. Such walls are more likely to be either 8" CMU with reinforcing @ 48" o.c. or 8" insulated concrete forms, both of which have a 55 pound per square foot weight.
- The original calculations use only the ASCE 7 load combination that applies a 0.75 factor for concurrent roof/snow and floor live loads, ignoring the load combinations that apply just the roof/attic LL, just the snow load, or just the total floor live loads.
- The original calculations are based on tributary width, yet Footnote #2 adds 2 inches of footing width for every 2 feet of additional **building width**. As a result of confusing building and tributary width, the footnote adds twice as much footing width as is necessary based on the loads!

Other key changes in the revised code text and footing tables include:

- The original footnote allowing footing width and depth to be adjusted is converted into two footnotes. One footnote requires an increase in footing width and depth when the building width perpendicular to a wall footing exceeds 32 feet. The second footnote permits, but does not require, a decrease in footing width and depth for a building width of 32 feet or narrower.
- The charging text is revised to clarify the minimum width of a footing shall not be less than 12 inches and depth shall not be less than 6 inches. Previously, the limitation on depth was buried in a footnote.

These revised tables correct the inconsistencies in the load assumptions and calculations. The result in many cases is footing widths for one- and two-family dwellings that are more in line with historic practice, while still technically justified under engineering standards and accepted practices. However, it is noted there are cases for houses on weaker soils (1500 and 2000 psf soil bearing strength) as well as for slab-on-grade and crawlspace houses, where corrections to the calculations, the assumption of clear-spanning roof trusses, and other changes to the assumptions increase the loads sufficiently to increase the footing widths.

Cost Impact: The code change proposal will increase the cost of construction
The revised tables increase footing sizes and depths for houses on weaker soils and slab-on-grade or crawlspace houses due to the revised calculations imposing larger loads on the footings. In other cases, correcting overly conservative assumptions result in modest reductions in footing size. Also, this proposal improves clarity regarding the base assumptions, which may allow more dwellings to be constructed using the table rather than having to rely on engineered design or other, more conservative, engineering-based prescriptive standards, thus some builders may save on both footing size and avoid engineering design fees.

RB164-19

Public Hearing Results

Errata: This proposal includes unpublished errata
(No change to portions of tables and footnotes not shown)

TABLE R403.1(1) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]

(1st column, 2nd row) 20 psf roof live load or 25 psf ground snow load

TABLE R403.1(3) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)[a, b, c, d]

b.The table is based on the following conditions and loads: Building width: 32 feet; Above-grade wall height: 9 feet; Slab-on-grade stem wall height: 1 foot; Crawlspace wall height: 4 feet; Dead loads: 15 psf roof and ceiling assembly, 10 psf floor assembly, 10 ~~100~~ psf wall assembly; Live loads: Roof and ground snow loads as listed, 10 psf attic floor, 40 psf first floor, 30 psf second and third floor. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.

Committee Action: As Modified

Committee Modification:
(No change to portions of tables or footnotes not shown)

TABLE R403.1(1) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

TABLE R403.1(2) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION WITH BRICK VENEER OR LATH AND PLASTER (inches)[a, b, c, d]

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

TABLE R403.1(3) MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)[a, b, c, d]

d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2 inch decrease in footing width and 1 inch decrease in footing depth is permitted for every 4 feet of decrease in building width, provided the minimum width is 12 inches (mm) and minimum depth is 6 inches (mm).

Committee Reason: Three concrete footing tables are revised for coordination with ASCE 7 and to address bearing forces from trusses with outward thrust. This is a needed improvements for builders. The committee felt the calculations and loads used to determine these revisions were adequate. The reason for the modification removed some duplication and improved clarity. There is a errata for Table R403.1(1) in the first column and Table R403.1(3) in footnote b. (Vote: 9-2)

Assembly Action: **None**

RB164-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Stephanie Young, representing National Council of Structural Engineers Associations (stephanie@mattsonmacdonald.com)

requests Disapprove

Commenter's Reason: The proponent states that the purpose of this Table is to allow the user of this Code to determine the required footing width for various scenarios within typical residential construction. Although we support the intent and general concept, the actual result of the approval of this particular Table would be an increase in the number of instances where an "engineered design" would be required.
As with all prescriptive designs, assumptions must be made with respect to loads, spans, and construction types. The assumptions made during the development of this Table are too limiting to help the typical end user.

In all of the following situations, the Table would not be applicable, resulting in the need for an "engineered design":

- Homes without a central bearing wall or supporting beam on all levels other than at the uppermost level.
- Homes with a bearing wall or supporting beam located anywhere but at the center of the structure.
- Roof structures which accommodate a current or future solar installation.
- Living spaces, other than "sleeping rooms", located on any floor above the main level.
- Living spaces or "sleeping rooms" located within the attic space.
- Floor assemblies with self-weight (dead load) greater than 10 psf.
  - Wood floor finishes would not be allowed
  - Tile floor finishes would not be allowed
  - Gypsum leveling material would not be allowed
  - Stone/granite and similar countertop materials would not be allowed
- Foundation wall heights greater than 8'-0"
- Foundation wall self-weights (dead load) greater than 120 psf

We are also concerned that the information contained in the footnotes is extremely important in determining the valid use of the Table and feel it will often be missed in the current location.

Since many of the scenarios listed above occur often in current construction, we would recommend the disapproval of this specific Table and suggest that the old Table be retained while a new Table is created which would be more universally applicable. Although the minimum footing width values will likely increase slightly, we feel that the expanded coverage of conditions would ultimately benefit a wider audience of users.

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# 1847

RB166-19

IRC®: R403.1.6, R404.1.3.3.6

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

2018 International Residential Code

Revise as follows:

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum $^1/_2$-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to $^1/_2$-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be located after the concrete is placed and before it has set in accordance with ACI 332.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

R404.1.3.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other *approved* material suitable for supporting and containing concrete. Forms shall be accurately positioned and secured before placing concrete and shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

Reason: ACI 332 Residential Code Requirements for Structural Concrete and Commentary is a standard used for residential concrete construction. Many residential foundation installations include "wet-set" anchor bolts to attach wood sills to foundations. This code change will codify a common practice that is not recognized as an accepted practice in ACI 318 Building Code Requirements for Structural Concrete and Commentary but is allowed in ACI 332. In some cases, "wet-setting" the anchor bolt is the only method by which the bolt can be placed. Insulated concrete forms (ICF's) as well as Concrete Masonry Units (CMU) allow this type of installation. The code change is limited to the wet setting of the anchor bolt connection to the wood sill. Forms that are to be embedded would need to be tied down or secured prior to the concrete pour.

Cost Impact: The code change proposal will decrease the cost of construction
It will reduce the labor and time in foundation construction in one and two family dwellings.

RB166-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt that this method to install anchor bolts needed to address consolidation. ACI 332 does not address this application. (Vote: 7-4)

Assembly Action: **None**

RB166-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R404.1.3.3.6, R403.1.6

Proponents:
Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R404.1.3.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other *approved* material suitable for supporting and containing concrete. Forms shall be ~~accurately~~ positioned and secured before placing concrete and shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of *braced wall panels* at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum $^{1}/_{2}$-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or *approved* anchors or anchor straps spaced as required to provide equivalent anchorage to $^{1}/_{2}$-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a *braced wall panel* shall be positively anchored with *approved* fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be permitted to be located ~~after the~~ while concrete is ~~placed~~ still plastic and before it has set ~~in accordance with ACI 332~~. Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).
2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset *braced wall panels* to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

Commenter's Reason: This public comment is being proposed by the proponent of the code change. During the Committee Action Hearings (CAH), concerns were expressed about the practice of wet setting anchor bolts and the consolidation of concrete around bolts. Voids can form in concrete not in full contact with the bolt. A requirement to vibrate the concrete where the concrete's plasticity is in question has been included and should address this concern.

The word "accurately" has been removed from the proposed language in R404.1.3.3.6 referring to the positioning of forms because it is subjective; a contractor or inspector might have a completely different opinion about the meaning of "accurate".

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Allowing the wet-setting of anchor bolts will decrease the labor needed to secure anchor bolts prior to concrete placement. The requirement added in the public comment to vibrate the concrete if it is losing its plasticity, might result in a small decrease the labor savings initially gained by allowing wet-setting.

Public Comment# 1243

RB174-19

IRC®: R406.2

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the higher of (a) the top of the footing or (b) 6 inches (152 mm) below the top of the basement floor, to the finished *grade*. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.
9. A drainage layer of not less than 4 inches (102 mm) of free draining granular material.
10. A drainage layer that provides equivalent performance to not less than 4 inches (102 mm) of free draining granular material.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and es-ters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

Reason: Obejective:
Provide more options for foundations waterproofing and dampproofing.

This code change provides addtional options for foundation waterproofing and dampproofing.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This provides additional options. Options seldom add costs and sometimes can reduce costs.

RB174-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt that the proposed addition would be more appropriate in Section R405. This could be addressed in an evaluation report; or equivalent performance is allowed by comparisons to Items 1 through 8. Item 9 could be an issue for drainage versus water proofing over the long term. (Vote: 11-0)

Assembly Action: **None**

RB174-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R406.2

Proponents:
Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below *grade* shall be waterproofed from the higher of (a) the top of the footing or (b) 6 inches (152 mm) below the top of the basement floor, to the finished *grade*. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.
9. A drainage layer of not less than 4 inches (102 mm) of free draining granular material having a void ratio of not less than 35 percent or a Size Number 4,5, 56, or 6 as classified by ASTM C33.
10. A drainage layer that provides equivalent performance to not less than 4 inches (102 mm) of free draining granular material having a void ratio of not less than 35 percent or a Size Number 4,5, 56, or 6 as classified by ASTM C33.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and es-ters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

Commenter's Reason: Committee reason is incorrect. In general drainage is a substitute for waterproofing and is recognized as such in the international codes. Also needs this modification to be consistent with S113.

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 does not change costs. It provides alternative means and methods of construction.

Public Comment# 1935

RB182-19

IRC: R506.1, CHAPTER 44 PTI (New)

Proposed Change as Submitted

Proponents: Amy Dowell, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

2018 International Residential Code

Revise as follows:

R506.1 General. Concrete slab-on-ground floors, other than post-tensioned slab-on-ground floors, shall be designed and constructed in accordance with the provisions of this section or ACI 332. ~~Floors~~ Such floors shall be a minimum $3^{1}/_{2}$ inches (89 mm) thick (for expansive soils, see Section R403.1.8). Post-tensioned concrete slabs-on-ground floors placed on expansive or stable soils shall be designed and constructed in accordance with PTI DC—10.5. The specified compressive strength of concrete shall be as set forth in Section R402.2.

Add new standard(s) as follows:

PTI

Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills MI 48331
US

DC—10.5-12: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils

Reason: There are currently no provisions for designing post-tensioned slabs on expansive or stable soils in IRC. This proposal includes a new reference to PTI standard PTI DC10.5-19, Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils.
Post-tensioned slabs are commonly used on stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Additional documentation can be viewed at http://ww2.post-tensioning.org/PDF_FILES/190102-DC10.5-Expansive and Stable Soils-Public Review.pdf.

Bibliography: .

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Staff Analysis: The referenced standard, PTI-DC-10.5-12, is currently referenced in other 2018 I-codes.

RB182-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The reference to PTI in the proposed requirement uses "constructed". PTI DC 10-5 is a design standard, not a construction standard. There are significant changes between the 2012 and the 2019 edition of this standard. Stable soils are not addressed in the 2012, but will be in the 2019. Once this new edition is finished, then a reference would be appropriate to reconsider. (Vote: 10-1)

Assembly Action: **None**

RB182-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R506.1, PTI (New)

Proponents:
Amy Dowell, Post-Tensioning Institute, representing Post-Tensioning Institute (amy.dowell@post-tensioning.org); Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R506.1 General. Concrete slab-on-ground floors, other than post-tensioned slab-on-ground floors, shall be designed and constructed in accordance with the provisions of this section or ACI 332. Such floors shall be a minimum $3^{1}/_{2}$ inches (89 mm) thick (for expansive soils, see Section R403.1.8). Post-tensioned concrete slabs-on-ground floors placed on expansive or stable soils shall be designed ~~and constructed~~ in accordance with PTI DC—10.5. The specified compressive strength of concrete shall be as set forth in Section R402.2.

PTI

Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills MI 48331
US

DC—10.5-~~12~~ 19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils

Commenter's Reason: We agree with the committee and the phrase " and constructed" was removed from the proposal because the PTI DC10.5-19 Standard does not cover construction.
PTI DC10.5-19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils has completed the consensus process and been published.

PTI DC10.5 is already referenced in IBC and is on the consent agenda for an administrative update to reference this new version published in 2019

Bibliography: PTI DC10.5-19: Standard Requirements for Design and Analysis of Shallow Concrete Foundations on Expansive and Stable Soils https://www.post-tensioning.org/publications/store/productdetail.aspx?ItemID=DC105&Language=English&Units=US_AND_METRIC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Post-tensioned slabs are commonly used on expansive and stable soils for crack control as well as reduced slab thickness and nonprestressed steel use. This reduction in material use typically offsets the cost of the post-tensioning materials and labor.

Public Comment# 1774

RB183-19

IRC®: R506.2.3, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Terry Kozlowski, representing Southern Nevada Chapter; Amanda Moss, representing SN-ICC Member; Cassidy Wilson, representing SN-ICC Member; Nenad Mirkovic, representing City of Las Vegas

2018 International Residential Code

Revise as follows:

R506.2.3 Vapor retarder. A ~~6-mil (0.006~~ 10-mil (0.010 inch; ~~152 μm)~~ 0.254 mm) polyethylene or *approved* vapor retarder conforming to ASTM E 1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

Reason: By coordinating the requirements for the vapor retarder with the American Concrete Institute (ACI) recommendations, this proposal will promote consistency across codes and standards for various moisture conditions.

Bibliography: ACI 302.2R Section 9.3:
"…ACI 302.1R recommends a minimum 10 mil (0.25 mm) vapor retarder thickness when the retarder is protected with a granular fill. When the vapor retarder is not protected by a fill, some specifiers require a 15 mil (0.38 mm) thickness or greater…"

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction for an average 2,200 square foot single-family dwelling by an estimated $28.60, based on cost analysis in current market conditions.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E1745-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB183-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:
R506.2.3 Vapor retarder. A minimum 10-mil (0.010 inch; 0.254 mm) ~~polyethylene or *approved*~~ vapor retarder conforming to ASTM E 1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports.

3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Committee Reason: The modification was approved because adding "minimum" adds clarity to the requirements; and polythylene was removed because all products can meet the standard. There is not the need to call out one product. The proposal was approved because the language would be in line with the concrete industry guidelines. The 6 mil was increased to 10 mill because the 6 mil products have not proved to be durable enough. The referenced standard would increase options. (Vote: 6-5)

Assembly Action: None

RB183-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R506.2.3

Proponents:
Stephen Szoke, representing American Concrete Institute (steve.szoke@concrete.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R506.2.3 Vapor retarder. A minimum ~~10~~ 6-mil (~~0.010~~ 0.006 inch; ~~0.254 mm~~ 152 µm) vapor retarder conforming to ASTM E1745 ~~Class A requirements~~ and with joints lapped not less than 6 inches (152 mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated *accessory structures*.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where *approved* by the *building official*, based on local site conditions.

Commenter's Reason: This code change proposal reduces the minimum thickness form 10 mil to 6 mil and reduces the specified class of materials conforming to ASTM E1745 from Class A to Class C.
These changes are intended to better align the provisions in the IRC with the recommendations of ACI Committee 302 on Construction of Concrete Floors as published in ACI 302.2R Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials which reads: "In the past, 4, 6, 8, and 10 mil (0.10, 0.15, 0.20, and 0.25 mm) low-density polyethylene sheets have been used as belowslab vapor retarder material. Any material used as a belowslab vapor retarder/barrier, however, should conform to the requirements of ASTM E 1745, 'Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs."

Since ACI 302.2R does not specify class, this public comment reduces the class to the minimum requirements of ASTM E1745 which is Class C.

Since ACI 302.2R does not specify thickness, as long as the material satisfies ASTM E1745 it would be preferable to not specify minimum thickness in the IRC. However, during the Committee Action Hearings arguments were made that 1) 6 mil polyethylene sheet is not sufficiently durable for applications as belowslab vapor retarders and 2) a minimum thickness should be specified since the IRC is intended to be prescriptive. ASTM E1745 does not specify materials and thus arguments made that 6 mil polyethylene sheet might not be sufficiently durable may not be applicable to 6 mil-thick membranes made of other materials. Since 6 mil was permitted in the 2018 IRC, this public comment reverts back to that as the minimum thickness.

Bibliography: 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
By limiting the criteria of this provision to any material conforming to ASTM E1745 and allowing minimum thickness of 6 mil, this provision should

not significantly increase the cost of construction as compared to the 2018 edition of the IRC, but could reduce costs compared to the the new provision presented as RB183-19.

Public Comment# 1250

Public Comment 2:

Proponents:

Gary Ehrlich, representing National Association of Home Builders (gehrlich@nahb.org)

requests Disapprove

Commenter's Reason: The proposed code change, if approved for the 2021 IRC, would limit product choice and increase cost by requiring the use of a proprietary underslab vapor retarder product as opposed to generic polyethylene sheet.
No technical data was provided that this change is necessary for houses. ACI 302.1R is a guide intended for slabs in industrial, commercial, and institutional buildings. No mention of houses is made anywhere in ACI 302.1R.

ACI 302.2R is a guide specific to moisture-sensitive flooring materials. Many common floor coverings used in houses are permeable or semi-permeable or do not rely on water-borne adhesives. They are not susceptible to trapping moisture coming up from the slab and thus do not need the protection of a thick, proprietary vapor retarder.

Section 5.2.3.1 of ACI 302.1R-2015 recommends vapor retarders comply with ASTM E1745 but does not specify a minimum thickness. Section 7.1.1 of ACI 302.2R-2006 contains equivalent language. ASTM E1745 itself merely defines the three classes of vapor retarders (Class A, Class B and Class C) with the associated performance specs for each class, but does not associate the three classes with particular uses or product thicknesses. While the 1996 and 2004 editions of ACI 302.1R did recommend a 10 mil thickness, that recommendation was removed in the current 2015 edition.

Even if one accepts the ACI recommendation that vapor retarders comply with ASTM E1745 is applicable to houses, ACI 302.1R and 302.2R do not recommend a specific class, nor has the proponent provided any substantiation as to why the most stringent class of underslab vapor retarder material is necessary in all cases.

The proponents underestimate the cost of going from generic 6 mil polyethylene to a proprietary 10 mil product. The material cost increase is on the order of $100 to $300 for a typical house depending on the product used and the size of the home, plus there is an additional cost due to the added labor needed to carry and install the heavier rolls of material.

It is noted a similar proposal last cycle was rejected 10-1 by the IRC-Building committee and 259-23 by ICC's governmental voting representatives during the Online Governmental Consensus Vote. RB183 only passed the IRC-Building committee by a single vote, showing there was not an overwhelming consensus this requirement was necessary as a new minimum standard for all houses and conditions. The IRC is a minimum code, and therefore this code change should be disapproved.

Bibliography: American Concrete Institute, 2015. *Guide to Concrete Floor and Slab Construction,* ACI 301.2R-15, ACI, Farmington Hills, MI.
American Concrete Institute, 2006. *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials,* ACI 302.2R-06, ACI, Farmington Hills, MI.

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# 1212

RB184-19

IRC: R507.1, TABLE R507.3.1, R507.4, TABLE R507.4, R507.5, TABLE R507.5, TABLE R507.5(2) (New), TABLE R507.5(3) (New), TABLE R507.5(4) (New), R507.6, TABLE R507.6, TABLE R507.9.1.3(1)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com)

2018 International Residential Code

Revise as follows:

R507.1 Decks. Wood-framed decks shall be in accordance with this section. Decks shall be designed for the live load required in Section R301.5 or the ground snow load indicated in Table R301.2(1), whichever is greater. For decks using materials and conditions not prescribed in this section, refer to Section R301.

TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD[b] (psf)	TRIBUTARY AREA[e] (sq. ft.)	SOIL BEARING CAPACITY[a, c, d]											
		1500 psf			2000 psf			~~2500~~[e]			≥ 3000 psf		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	~~Side of a square footing~~ ~~(inches)~~	~~Diameter of a round footing~~ ~~(inches)~~	~~Thickness~~ ~~(inches)~~	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)
40	5	7	8	6	7	8	6	7	8	6			
	20	~~12~~ 10	~~14~~ 10	6	~~12~~ 9	~~14~~ 9	6	~~12~~	~~14~~	~~6~~	~~12~~ 7	~~14~~ 8	6
	40	14	~~16~~ 14	~~6~~ 7	12	~~14~~ 13	6	~~12~~	~~14~~	~~6~~	~~12~~ 10	~~14~~ 10	6
	60	17	~~19~~ 18	~~6~~ 9	15	~~17~~ 15	~~6~~ 8	~~13~~	~~15~~	~~6~~	12	~~14~~ 13	6
	80	20	22	7	17	19	6	~~15~~	~~17~~	~~6~~	14	16	6
	100	22	25	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17	6
	120	24	27	9	21	23	7	~~19~~	~~21~~	~~6~~	17	19	6
	140	26	29	10	22	25	8	~~20~~	~~23~~	~~7~~	18	21	6
	160	28	31	11	24	27	9	~~21~~	~~24~~	~~8~~	20	22	7
50	5	7	8	6	7	8	6	7	8	6			
	20	~~12~~ 11	~~14~~ 12	6	~~12~~ 10	~~14~~ 10	6	~~12~~	~~14~~	~~6~~	~~12~~ 8	~~14~~ 8	6
	40	~~15~~ 16	~~17~~ 16	6	~~13~~ 8	~~15~~ 14	6	~~12~~	~~14~~	~~6~~	~~12~~ 11	~~14~~ 12	6
	60	19	21	6	16	18	6	~~14~~	~~16~~	~~6~~	13	15	6
	80	21	24	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17	6
	100	24	27	9	21	23	7	~~19~~	~~21~~	~~6~~	17	19	6
	120	26	30	10	23	26	8	~~20~~	~~23~~	~~7~~	19	21	6
	140	28	32	11	25	28	9	~~22~~	~~25~~	~~8~~	20	23	7
	160	30	34	12	26	30	10	~~24~~	~~27~~	~~9~~	21	24	8
60	5	7	8	6	7	8	6	7	8	6			
	20	12	~~14~~ 13	6	~~12~~ 11	~~14~~ 11	6	~~12~~	~~14~~	~~6~~	~~12~~ 9	~~14~~ 9	6
	40	~~16~~ 17	~~19~~ 18	6	~~14~~ 15	~~16~~ 15	~~6~~ 8	~~13~~	~~14~~	~~6~~	12	~~14~~ 13	6
	60	20	23	7	17	20	6	~~16~~	~~18~~	~~6~~	14	16	6
	80	23	26	9	20	23	7	~~18~~	~~20~~	~~6~~	16	19	6
	100	26	29	10	22	25	8	~~20~~	~~23~~	~~7~~	18	21	6
	120	28	32	11	25	28	9	~~22~~	~~25~~	~~8~~	20	23	7
	140	31	35	12	27	30	10	~~24~~	~~27~~	~~9~~	22	24	8
	160	33	37	13	28	32	11	~~25~~	~~29~~	~~10~~	23	26	9

70	<u>5</u>	<u>7</u>	<u>8</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>6</u>			
	20	~~12~~ <u>13</u>	14	~~6~~ <u>7</u>	~~12~~ <u>11</u>	~~14~~ <u>12</u>	6	~~12~~	~~14~~	~~6~~	~~12~~ <u>9</u>	~~14~~ <u>10</u>	6
	40	18	~~20~~ <u>19</u>	~~6~~ <u>9</u>	~~15~~ <u>16</u>	17	~~6~~ <u>8</u>	~~14~~	~~16~~	~~6~~	~~12~~ <u>13</u>	14	~~6~~ <u>7</u>
	60	21	24	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17	6
	80	25	28	9	21	24	8	~~19~~	~~22~~	~~7~~	18	20	6
	100	28	31	11	24	27	9	~~21~~	~~24~~	~~8~~	20	22	7
	120	30	34	12	26	30	10	~~24~~	~~27~~	~~9~~	21	24	8
	140	33	37	13	28	32	11	~~25~~	~~29~~	~~10~~	23	26	9
	160	35	40	15	30	34	12	~~27~~	~~31~~	~~11~~	25	28	9

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.
a. Interpolation permitted, extrapolation not permitted.
b. Based on highest load case: Dead + Live or Dead + Snow.
c. ~~Assumes minimum square footing to be 12 inches x 12 inches x 6 inches for 6 x 6 post~~ <u>Footing dimensions shall allow complete bearing of the post</u>.
d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
e. Area, in square feet, of deck surface supported by post and footings.
<u>f. Minimum thickness shall only apply to plain concrete footings.</u>

R507.4 Deck posts. For single-level ~~wood-framed~~ decks ~~with beams sized in accordance with Table R507.5,~~ <u>wood</u> deck post size shall be in accordance with Table R507.4.

Delete and substitute as follows:

TABLE R507.4
DECK POST HEIGHT[a]

DECK POST SIZE	MAXIMUM HEIGHT[a, b] (feet-inches)
4 × 4	6-9[c]
4 × 6	8
6 × 6	14
8 × 8	14

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Measured to the underside of the beam.
b. Based on 40 psf live load.
c. The maximum permitted height is 8 feet for one-ply and two-ply beams. The maximum permitted height for three-ply beams on post cap is 6 feet 9 inches.

TABLE R507.4
DECK POST HEIGHT

LOADS[b] (psf)	POST SPECIES[c]	POST SIZE[d]	TRIBUTARY AREA[g, h] (sqft)							
			20	40	60	80	100	120	140	160
			MAXIMUM DECK POST HEIGHT[a] (feet-inches)							
40 Live Load	Southern Pine	4 x 4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2
		4 x 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2
		6 x 6	14-0	14-0	11-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir[e], Hem-fir[e], SPF[e]	4 x 4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3
		4 x 6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	4 x 4	14-0	12-1	9-8	8-22	7-1	6-2	5-3	4-2
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
50 Ground Snow Load	Southern Pine	4 x 4	14-0	12-2	9-10	8-5	7-5	9-7	5-11	5-4
		4 x 6	14-0	14-0	12-6	10-9	9-6	8-7	7-10	7-3
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	13-4
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir[e], Hem-fir[e], SPF[e]	4 x 4	14-0	12-1	9-8	8-2	7-1	6-2	5-3	4-2
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	4 x 4	14-0	11-8	9-0	6-10	3-7	NP	NP	NP
		4 x 6	14-0	14-0	12-0	10-0	8-6	7-0	5-3	NP
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Southern Pine	4 x 4	14-0	11-1	8-11	7-7	6-7	5-10	5-2	4-6
		4 x 6	14-0	14-0	11-4	9-9	8-7	7-9	7-1	6-6
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-9	11-2
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

LOADS 60**(psf)** Ground	**POST SPECIES**	**POST SIZE**	**TRIBUTARY AREA (sqft)**							
			20	**40**	**60**	**80**	**100**	**120**	**140**	**160**
			MAXIMUM DECK POST HEIGHT (feet-inches)							
Snow Load	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	10-11	8-8	7-3	6-2	5-0	3-7	NP
		4 x 6	14-0	13-11	112-	9-7	8-4	7-5	6-8	5-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-2	10-2
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars f, Ponderosa Pine f, Red Pine f	4 x 4	14-0	10-6	7-9	4-7	NP	NP	NP	NP
		4 x 6	14-0	13-7	10-9	8-9	7-0	4-9	NP	NP
		6 x 6	14-0	14-0	14-0	14-0	14-0	9-9	NP	NP
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
70 Ground Snow Load	Southern Pine	4 x 4	14-0	10-2	8-2	6-11	5-11	5-2	4-4	3-4
		4 x 6	14-0	12-11	10-5	8-11	7-10	7-1	6-5	5-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	12-9	10-11	8-7
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
		4 x 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	4 x 4	14-0	9-5	6-5	NP	NP	NP	NP	NP
		4 x 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP
		6 x 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa., NP = Not Permitted

a. Measured from the underside of the beam to top of footing or pier.

b. 10 psf dead load. Snow load not assumed to be concurrent with live load.

c. No. 2 grade, wet service factor included.

d. Notched deck posts shall be sized to accommodate beam size per in accordance with Section R507.5.2

e. Includes incising factor.

f. Incising factor not included.

g. Area, in square feet, of deck surface supported by post and footings.

h. Interpolation permitted. Extrapolation not permitted.

Revise as follows:

R507.5 Deck Beams. Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with ~~Table R507.5.~~ Tables R507.5(1) through R507(4). Beam plies shall be fastened with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the allowable beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.

Delete and substitute as follows:

TABLE R507.5
DECK BEAM SPAN LENGTHS[a, b, g] (feet - inches)

SPECIES[c]	SIZE[d]	DECK JOIST SPAN LESS THAN OR EQUAL TO:(feet)						
		6	8	10	12	14	16	18
Southern pine	1 — 2 × 6	4-11	4-0	3-7	3-3	3-0	2-10	2-8
	1 — 2 × 8	5-11	5-1	4-7	4-2	2-10	3-7	3-5
	1 — 2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1 — 2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2 — 2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2 — 2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2 — 2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2 — 2 × 12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3 — 2 × 6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3 — 2 × 8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3 — 2 × 10	13-0	11-3	10-0	9-2	8-6	7-11	7-6
	3 — 2 × 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10
Douglas fir-larch[e],hem-fir[e],spruce-pine-fir[e],redwood,western cedars,ponderosa pine[f],red pine[f]	3 × 6 or 2 — 2 × 6	5-5	4-8	4-2	3-10	3-6	3-1	2-9
	3 × 8 or 2 — 2 × 8	6-10	5-11	5-4	4-10	4-6	4-1	3-8
	3 × 10 or 2 — 2 × 10	8-4	7-3	6-6	5-11	5-6	5-1	4-8
	3 × 12 or 2 — 2 × 12	9-8	8-5	7-6	6-10	6-4	5-11	5-7
	4 × 6	6-5	5-6	4-11	4-6	4-2	3-11	3-8
	4 × 8	8-5	7-3	6-6	5-11	5-6	5-2	4-10
	4 × 10	9-11	8-7	7-8	7-0	6-6	6-1	5-8
	4 × 12	11-5	9-11	8-10	8-1	7-6	7-0	6-7
	3 — 2 × 6	7-4	6-8	6-0	5-6	5-1	4-9	4-6
	3 — 2 × 8	9-8	8-6	7-7	6-11	6-5	6-0	5-8
	3 — 2 × 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3 — 2 × 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound point load applied at the end.
b. Beams supporting deck joists from one side only.
c. No. 2 grade, wet service factor.
d. Beam depth shall be greater than or equal to depth of joists with a flush beam condition.
e. Includes incising factor.
f. Northern species. Incising factor not included.
g. Beam cantilevers are limited to the adjacent beam's span divided by 4.

TABLE R507.5(1)
MAXIMUM DECK BEAM SPAN LENGTHS[a, b, g] (feet - inches) - 40 PSF LIVE LOAD [c]

BEAM SPECIES [e d]	BEAM SIZE [d e]	DECK JOIST SPAN [a, i] LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN [a, b, f] (feet -inches)						
Southern p Pine	1 – 2 × 6	4-11 4-7	4-0	3-7	3-3	3-0	2-10	2-8 2-7
	1 – 2 × 8	5-11 5-10	5-1	4-7 4-6	4-2 4-1	2-10 3-10	3-7	3-5 3-4
	1 – 2 × 10	7-0 6-11	6-0	5-5 5-4	4-11	4-7 4-6	4-3	4-0
	1 – 2 × 12	8-3 8-2	7-1	6-4	5-10 5-9	5-5 5-4	5-0	4-9 4-8
	2 – 2 × 6	6-11 6-10	5-11	5-4 5-3	4-10	4-6	4-3 4-2	4-0 3-11
	2 – 2 × 8	8-9 8-8	7-7 7-6	6-9	6-2	5-9 5-8	5-4	5-0
	2 – 2 × 10	10-4	9-0 8-11	8-0	7-4 7-3	6-9	6-4	6-0 5-11
	2 – 2 × 12	12-2	10-7 10-6	9-5	8-7	8-0 7-11	7-6 7-5	7-0
	3 – 2 × 6	8-2 8-6	7-5	6-8	6-1	5-8 5-7	5-3	5-0 4-11
	3 – 2 × 8	10-10 10-11	9-6 9-5	8-6 8-5	7-9 7-8	7-2 7-1	6-8	6-4 6-3
	3 – 2 × 10	13-0 12-11	11-3 11-2	10-0	9-2 9-1	8-6 8-5	7-11	7-6 7-5
	3 – 2 × 12	15-3	13-3 13-2	11-10 11-9	10-9	10-0 9-11	9-4	8-10 8-9

BEAM SPECIES	BEAM SIZE	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN (feet -inches)						
Douglas fir-larch [e g], hHem-fir [e g], Spruce-pine-fir [e g], redwood, western cedars, ponderosa pine[f], red pine[f]	3 × 6 or 2 1– 2 x 6	5-5 4-1	4-8 3-6	4-2 3-0	3-10 2-6	3-6 2-1	3-1 1-10	2-9 1-7
	3 × 8 or 2 1–2 × 8	6-10 5-6	5-11 4-9	5-4 4-0	4-10 3-3	4-6 2-9	4-1 2-5	3-8 2-1
	3 × 10 or 2 1– 2 × 10	8-4 6-8	7-3 5-10	6-6 5-1	5-11 4-2	5-6 3-6	5-1 3-1	4-8 2-8
	3 × 12 or 2 1– 2 × 12	9-8 7-9	8-5 6-9	7-6 6-0	6-10 5-1	6-4 4-4	5-11 3-9	5-7 3-3
	4 × 6 2-2 x 6	6-5 6-1	5-6 5-3	4-11 4-9	4-6 4-4	4-2 4-0	3-11 3-8	3-8 3-3
	4 × 8 2-2 x 8	8-5 8-2	7-3 7-1	6-6 6-4	5-11 5-9	5-6 5-4	5-2 4-10	4-10 4-3
	4 × 10 2-2 x 10	9-11 10-0	8-7	7-8 7-9	7-0	6-6	6-1	5-8 5-5
	4 × 12 2-2 x 12	11-5 11-7	9-11 10-0	8-10 8-11	8-1 8-2	7-6 7-7	7-0 7-1	6-7
	3 – 2 × 6	7-4 7-8	6-8 6-7	6-0 5-11	5-6 5-5	5-1 5-0	4-9 4-8	4-6 4-5
	3 – 2 × 8	9-8 10-3	8-6 8-10	7-7 7-11	6-11 7-3	6-5 6-8	6-0 6-3	5-8 5-11
	3 – 2 × 10	12-0 12-6	10-5 10-10	9-4 9-8	8-6 8-10	7-10 8-2	7-4 7-8	6-11 7-2
	3 – 2 × 12	13-11 14-6	12-1 12-7	10-9 11-3	9-10 10-3	9-1 9-6	8-6 8-11	8-1 8-5
Redwood [h],	1 - 2 x 6	4-2	3-7	3-1	2-7	2-2	1-10	1-8
	1 - 2 x 8	5-4	4-7	4-1	3-4	2-10	2-6	2-2
	1 - 2 x 10	6-6	5-7	5-0	4-3	3-8	3-2	2-9
	1 - 2 x 12	7-6	6-6	5-10	5-3	4-5	3-10	3-5
	2 - 2 x 6	6-2	5-4	4-10	4-5	4-1	3-9	3-4
	2 - 2 x 8	7-10	6-10	6-1	5-7	5-2	4-10	4-4
	2 - 2 x10	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	2 - 2 x 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5

BEAM SPECIES	BEAM SIZE	DECK JOIST SPAN LESS THAN OR EQUAL TO: (feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN (feet -inches)						
Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	3 - 2 x 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6
	3 - 2 x 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8
	3 - 2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3 - 2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation permitted. Extrapolation not permitted.

b. Beams supporting a single span of joists with or without cantilever.

c. a. Ground snow load, live load = 40 psf, dead Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound point load applied at the end. Snow load not assumed to be concurrent with live load.

b.Beams supporting deck joists from one side only.

d. c.No. 2 grade, wet service factor included.

e. d.Beam depth shall be equal to or greater than or equal to depth of joists with the depth intersecting joist for a flush beam condition connection.

f. g. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. e.Includes incising factor.

h. f. Northern species.Incising factor not included.

i. Deck joist span as shown in Figure R507.5

Add new text as follows:

TABLE R507.5(2)
MAXIMUM DECK BEAM SPAN - 50 PSF GROUND SNOW LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	DECK JOIST SPAN (feet)[a, i] 6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN (feet-inches) [a, b, f]						
Southern Pine	1-2x6	4-2	3-8	3-3	2-11	2-9	2-5	2-2
	1-2x8	5-4	4-7	4-1	3-9	3-6	3-3	2-10
	1-2x10	6-4	5-6	4-11	4-6	4-2	3-10	3-8
	1-2x12	7-6	6-5	5-9	5-3	4-10	4-7	4-3
	2-2x6	6-3	5-5	4-10	4-5	4-1	3-10	3-7
	2-2x8	7-11	6-10	6-2	5-7	5-2	4-10	4-7
	2-2x10	9-5	8-2	7-3	6-8	6-2	5-9	5-5
	2-2x12	11-1	9-7	8-7	7-10	7-3	6-9	6-5
	3-2x6	7-10	6-9	6-1	5-6	5-1	4-9	4-6
	3-2x8	9-11	8-7	7-8	7-0	6-6	6-16	5-9
	3-2x10	11-9	10-2	9-1	8-4	7-8	7-2	6-9
	3-2x12	13-11	12-0	10-9	9-10	9-1	8-6	8-0
Douglas fir-larch [g], Hem-fir [g], Spruce-pine-fir [g]	1-2x6	3-9	3-3	2-6	2-1	1-9	1-6	1-4
	1-2x8	5-0	4-3	3-4	2-9	2-3	2-0	1-9
	1-2x10	6-1	5-4	4-3	3-6	2-11	2-6	2-3
	1-2x12	7-1	6-2	5-2	4-3	3-7	3-1	2-9
	2-2x6	5-7	4-10	4-4	3-11	3-6	3-0	2-8
	2-2x8	7-5	6-5	5-9	5-3	4-7	4-0	3-6
	2-2x10	9-1	7-10	7-0	6-5	5-11	5-1	4-6
	2-2x12	10-7	9-2	8-2	7-5	6-11	6-3	5-6
	3-2x6	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	3-2x8	9-4	8-1	7-3	6-7	6-1	5-8	5-4
	3-2x10	11-5	9-10	8-10	8-1	7-5	7-0	6-7
	3-2x12	13-3	11-6	10-3	9-5	8-8	8-1	7-8
Redwood [h], Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	1-2x6	3-10	3-4	2-7	2-2	1-10	1-7	1-5
	1-2x8	4-10	4-2	3-5	2-10	2-4	2-1	1-10
	1-2x10	5-11	5-1	4-4	3-7	3-0	2-8	2-4
	1-2x12	6-10	5-11	5-4	4-4	3-8	3-2	2-10
	2-2x6	5-8	4-11	4-5	4-0	3-7	3-1	2-9
	2-2x8	7-2	6-3	5-7	5-1	4-8	4-1	3-8
	2-2x10	8-9	7-7	6-9	6-2	5-9	5-3	4-8
	2-2x12	10-2	8-10	7-10	7-2	6-8	6-3	5-8
	3-2x6	7-1	6-2	5-6	5-0	4-8	4-4	4-1
	3-2x8	9-0	7-9	6-11	6-4	5-11	5-6	5-2
	3-2x10	11-0	9-6	8-6	7-9	7-2	6-9	6-4
	3-2x12	12-9	11-0	9-10	9-0	8-4	7-9	7-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(3)
MAXIMUM DECK BEAM SPAN - 60 PSF GROUND SNOW LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	DECK JOIST SPAN [a, h] (feet)						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN [a, b, f]						
Southern pine	1-2x6	3-11	3-4	3-0	2-9	2-5	2-1	1-10
	1-2x8	4-11	4-3	3-10	3-6	3-2	2-9	2-5
	1-2x10	5-10	5-1	4-6	4-2	3-10	3-6	3-1
	1-2x10	6-11	6-0	5-4	4-10	4-6	4-3	3-10
	2-2x6	5-9	5-0	4-6	4-1	3-9	3-6	3-4
	2-2x8	7-4	6-4	5-8	5-2	4-9	4-6	4-3
	2-2x10	8-8	7-6	6-9	6-2	5-8	5-4	5-0
	2-2x12	10-3	8-11	7-11	7-3	6-8	6-3	5-11
	3-2x6	7-3	6-3	5-7	5-1	4-9	4-5	4-2
	3-2x8	9-2	7-11	7-1	6-6	6-0	5-7	5-3
	3-2x10	10-11	9-5	8-5	7-8	7-2	6-8	6-3
	3-2x12	12-10	11-2	9-11	9-1	8-5	7-10	7-5
Douglas fir-larch [g], Hem-fir [g], Spruce-pine-fir [g]	1-2x6	3-5	2-9	2-2	1-9	1-6	1-3	1-1
	1-2x8	4-8	3-8	2-10	2-4	1-11	1-8	1-6
	1-2x10	5-8	4-8	3-8	3-0	2-6	2-2	1-11
	1-2x12	6-7	5-8	4-5	3-7	3-1	2-7	2-3
	2-2x6	5-2	4-5	4-0	3-6	3-0	1-11	1-8
	2-2x8	6-11	5-11	5-4	4-8	3-11	3-5	3-0
	2-2x10	8-5	7-3	6-6	5-11	5-1	4-5	3-10
	2-2x12	9-9	8-5	7-7	6-11	6-2	5-4	4-8
	3-2x6	6-5	5-7	5-0	4-7	4-3	3-11	3-5
	3-2x8	8-8	7-6	6-8	6-1	5-8	5-2	4-7
	3-2x10	10-7	9-2	8-2	7-5	6-11	6-5	5-10
	3-2x12	12-3	10-8	9-6	8-8	8-0	7-6	7-1
Redwood [h], Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	1-2x6	3-6	2-10	2-3	1-10	1-7	1-4	1-2
	1-2x8	4-6	3-9	2-11	2-5	2-0	1-9	1-7
	1-2x10	5-6	4-9	3-9	3-1	2-7	2-3	2-0
	1-2x12	6-4	5-6	4-7	3-9	3-2	2-9	2-5
	2-2x6	5-3	4-6	4-1	3-8	3-1	2-8	2-4
	2-2x8	6-8	5-9	5-2	4-8	4-1	3-6	3-1
	2-2x10	8-1	7-0	6-3	5-9	5-2	4-6	4-0
	2-2x12	9-5	8-2	7-3	6-8	6-2	5-6	4-10
	3-2x6	6-7	5-8	5-1	4-8	4-4	4-0	3-7
	3-2x8	8-4	7-2	6-5	5-11	5-5	5-1	4-8
	3-2x10	10-2	8-10	7-10	7-2	6-8	6-3	5-10
	3-2x12	11-9	10-2	9-1	8-4	7-8	7-3	6-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(4)
MAXIMUM DECK BEAM SPAN - 70 PSF GROUND SNOW LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	DECK JOIST SPAN (feet) [a, i]						
		6	8	10	12	14	16	18
		MAXIMUM BEAM SPAN [a, b, f] (feet-inches)						
Southern Pine	1-2x6	3-8	3-2	2-10	2-1	1-10	1-4	1-7
	1-2x8	4-7	4-0	3-7	3-3	2-9	2-5	2-2
	1-2x10	5-6	4-9	4-3	3-10	3-7	3-1	2-9
	1-2x12	6-5	5-7	5-0	4-7	4-3	3-9	3-4
	2-2x6	5-5	4-8	4-2	3-10	3-6	3-3	3-1
	2-2x8	6-10	5-11	5-4	4-10	4-6	4-2	3-11
	2-2x10	8-2	7-1	6-4	5-9	5-4	5-0	4-8
	2-2x12	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	3-2x6	6-9	5-10	5-3	4-9	4-5	4-2	3-11
	3-2x8	8-7	7-5	6-8	6-1	5-7	5-3	4-11
	3-2x10	10-2	8-10	7-11	7-2	6-8	6-3	5-10
	3-2x12	12-0	10-5	9-4	8-6	7-10	7-41	6-11
Douglas fir-larch [g], Hem-fir [g], Spruce -pine-fir [g]	1-2x6	3-3	2-5	1-10	1-6	1-3	1-1	1-0
	1-2x8	4-4	3-2	2-6	2-0	1-8	1-6	1-4
	1-2x10	5-4	4-1	3-2	2-7	2-2	1-11	1-8
	1-2x12	6-2	5-0	3-10	3-2	2-8	2-4	2-0
	2-2x6	4-10	4-2	3-9	3-1	2-7	2-3	2-0
	2-2x8	6-5	5-7	5-0	4-1	3-5	3-0	2-8
	2-2x10	7-10	6-10	6-1	5-39	4-5	3-10	3-5
	2-2x12	9-2	7-11	7-1	6-4	5-5	4-8	4-1
	3-2x6	6-0	5-31	4-8	4-3	3-11	3-5	3-0
	3-2x8	8-1	7-0	6-3	5-8	5-2	4-6	4-0
	3-2x10	9-10	8-6	7-8	7-0	6-5	5-9	5-1
	3-2x12	11-6	9-11	8-11	8-1	7-6	7-0	6-3
Redwood [h], Western Cedars [h], Poderosa Pine [h], Red Pine [h]	1-2x6	3-4	2-6	1-11	1-7	1-4	1-2	1-0
	1-2x8	4-2	3-3	2-7	2-1	1-9	1-7	1-4
	1-2x10	5-1	4-2	3-3	2-8	2-3	2-0	1-9
	1-2x12	5-11	5-1	4-0	3-3	2-9	2-5	2-1
	2-2x6	4-11	4-3	3-10	3-2	2-8	2-4	2-1
	2-2x8	6-3	5-5	4-10	4-2	3-7	3-1	2-9
	2-2x10	7-7	6-7	5-10	5-4	4-7	3-11	3-6
	2-2x12	8-10	7-7	6-10	6-3	5-6	4-10	4-3
	3-2x6	6-2	5-4	4-9	4-4	4-0	3-6	3-1
	3-2x8	7-9	6-9	6-0	5-6	5-1	4-8	4-1
	3-2x10	9-6	8-3	7-4	6-9	6-3	5-10	5-3
	3-2x12	11-0	9-6	8-6	7-9	7-3	6-9	6-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

Revise as follows:

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7. ~~The maximum joist cantilever shall be limited to one-fourth of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.~~

Delete and substitute as follows:

TABLE R507.6
DECK JOIST SPANS FOR COMMON LUMBER SPECIES (ft. - in.)

SPECIES[a]	SIZE	ALLOWABLE JOIST SPAN[b] SPACING OF DECK JOISTS(inches)			MAXIMUM CANTILEVER[c, f] SPACING OF DECK JOISTS WITH CANTILEVERS[c] (inches)		
		12	16	24	12	16	24
Southern pine	2 × 6	9-11	9-0	7-7	1-3	1-4	1-6
	2 × 8	13-1	11-10	9-8	2-1	2-3	2-5
	2 × 10	16-2	14-0	11-5	3-4	3-6	2-10
	2 × 12	18-0	16-6	13-6	4-6	4-2	3-4
Douglas fir-larch[d], hem-fir[d] spruce-pine-fir[d],	2 × 6	9-6	8-8	7-2	1-2	1-3	1-5
	2 × 8	12-6	11-1	9-1	1-11	2-1	2-3
	2 × 10	15-8	13-7	11-1	3-1	3-5	2-9
	2 × 12	18-0	15-9	12-10	4-6	3-11	3-3
Redwood,western cedars, ponderosa pine[e], red pine[e]	2 × 6	8-10	8-0	7-0	1-0	1-1	1-2
	2 × 8	11-8	10-7	8-8	1-8	1-10	2-0
	2 × 10	14-11	13-0	10-7	2-8	2-10	2-8
	2 × 12	17-5	15-1	12-4	3-10	3-9	3-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a.No. 2 grade with wet service factor.
b.Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360.
c.Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound point load applied to end.
d.Includes incising factor.
e.Northern species with no incising factor.
f.Cantilevered spans not exceeding the nominal depth of the joist are permitted.

TABLE R507.6
MAXIMUM DECK JOIST SPANS

LOAD [a] (psf)	JOIST SPECIES [b]	JOIST SIZE	JOIST SPACING (inches)			ADJACENT JOIST SPAN [g] (feet)							
			12	16	24	4	6	8	10	12	14	16	18
			MAXIMUM JOIST SPAN [c] (feet-inches)			MAXIMUM CANTILEVER [d] (feet-inches)							
40 Live Load	Southern Pine	2x6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP
		2x10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP
		2x12	18-0	16-6	13-6	1-0	1-6	2-0	-6	3-0	3-6	4-0	4-1
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP	NP
		2x10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
		2x12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	3-11
	Redwood f, Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2x8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP
		2x12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
50 Ground Snow Load	Southern Pine	2x6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	12-1	11-0	9-7	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
		2x10	15-5	14-1	12-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
		2x12	18-0	17-1	14-6	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	8-10	8-0	7-0	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	11-7	10-7	9-3	1-0	1-6	2-0	2-3	NP	NP	NP	NP
		2x10	14-10	13-6	11-9	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP
		2x12	18-0	16-5	13-9	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
	Redwood f, Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	8-3	7-6	6-8	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2x8	10-10	9-10	8-7	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	13-10	12-7	11-0	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	16-10	15-3	13-2	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Southern Pine	2x6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	11-5	10-4	9-1	1-0	1-6	2-0	2-4	NP	NP	NP	NP
		2x10	14-7	13-3	11-7	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
		2x12	17-8	16-1	14-0	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP
		2x6	8-4	7-6	6-7	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	10-11	9-11	8-8	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	13-11	12-8	11-1	1-0	1-6	2-0	2-6	2-10	NP	NP	NP
		2x12	17-0	15-5	13-6	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
60 Ground	Douglas fir-larch [e], Hem-fir [e],												

Snow Load LOAD (psf)	Spruce-pine-fir [e] JOIST SPECIES	JOIST SIZE	JOIST SPACING (inches)			ADJACENT JOIST SPAN (feet)							
			12	16	24	4	6	8	10	12	14	16	18
			MAXIMUM JOIST SPAN (feet-inches)			MAXIMUM CANTILEVER (feet-inches)							
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP	NP
		2x8	10-2	9-3	8-1	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	13-0	11-10	10-4	1-0	1-6	2-0	2-6	2-7	NP	NP	NP
		2x12	15-10	14-4	12-7	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP
70 Ground Snow Load	Southern Pine	2x6	8-3	7-6	6-6	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	10-10	9-10	8-7	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	13-10	12-7	11-0	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	16-10	15-3	13-4	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	7-11	7-2	6-3	1-0	1-6	NP	NP	NP	NP	NP	NP
		2x8	10-5	9-5	8-3	1-0	1-6	2-0	2-1	NP	NP	NP	NP
		2x10	13-3	12-0	10-6	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
		2012	16-1	14-8	12-10	1-0	1-6	2-0	2-6	3-0	3-3	3-3	NP
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
		2x8	9-8	8-10	7-8	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2x10	12-4	11-3	9-10	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
		2x12	15-0	13-8	11-11	1-0	1-6	2-0	2-6	2-0	3-0	NP	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not Permitted

a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.

b. No. 2 grade, wet service factor included.

c. L/Δ = 360 at main span.

d. L/Δ = 180 at cantilever with 220-pound point load applied to end.

e. Includes incising factor.

f. Incising factor not included.

g. Interpolation permitted. Extrapolation is not permitted.

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST[a, b] (Deck live load = 40 psf, deck dead load = 10 psf, snow load ≤ 40 psf)

CONNECTION DETAILS	JOIST SPAN						
	6′ and less	6′1″ to 8′	8′1″ to 10′	10′1″ to 12′	12′1″ to 14′	14′1″ to 16′	16′1″ to 18′
	On-center spacing of fasteners						
$^1/_2$-inch diameter lag screw with $^1/_2$-inch maximum sheathing[c, d]	30	23	18	15	13	11	10
$^1/_2$-inch diameter bolt with $^1/_2$-inch maximum sheathing[d]	36	36	34	29	24	21	19
$^1/_2$-inch diameter bolt with 1-inch maximum sheathing[e]	36	36	29	24	21	18	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a.Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
b.Snow load shall not be assumed to act concurrently with live load.
c. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
d.Sheathing shall be wood structural panel or solid sawn lumber.
e.Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to $^1/_2$-inch thickness of stacked washers shall be permitted to substitute for up to $^1/_2$ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST

LOAD[c] (psf)	JOIST SPAN[a] (feet)	1/2-inch diameter lag screw with 1/2-inch maximum sheathing[d, e]	1/2-inch diameter bolt with 1/2-inch maximum sheathing[e]	1/2-inch diameter bolt with 1-inch maximum sheathing[f]
		On-CENTER SPACING OF FASTENERS[b] (inches)		
40 Live Load	6	30	36	36
	8	23	36	36
	10	18	34	29
	12	15	29	24
	14	13	24	21
	16	11	21	18
	18	10	19	16
50 Ground Snow Load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 Ground Snow Load	6	25	36	36
	8	18	35	30
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
70 Ground Snow Load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted. Extrapolation is not permitted.

b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.

c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.

d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.

e. Sheathing shall be wood structural panel or solid sawn lumber.

f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to $^{1}/_{2}$-inch thickness of stacked washers shall be permitted to substitute for up to $^{1}/_{2}$ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

Reason: From roughly scanning Figure R301.2(6) Ground Snow Loads, it appears that as much as ten percent of the country lives in areas where the ground snow load exceeds the live load in Table R301.5. The Deck Code Coalition proposes to prescriptively offer the people in these areas with revised tables.
The IRC's prescriptive deck provisions currently only include a 40 psf live load and 10 psf dead load. This proposal is to widen the deck provisions to include up to 70 psf ground snow load to more closely match the scope of the IRC.

For snow loading, an increase in wood strength is accounted for the load duration per the NDS®. While the geometry of the deck and nearby structures can affect the snow loading by causing drifts or snow falling from a nearby roof, these effects are neglected just as in other IRC tables, such as roof rafters. Similarly, elevated decks would have a snow load less than the ground snow load, but this reduction is neglected for simpler tables that are easy to use.

· Table R507.3.1 Minimum Footing Size for Decks - currently the table includes footings from 40 to 70 psf, but limits the minimum size of footing to 12" x 12", which is significantly oversized for small areas such as a stair landing. New rows have been added for a smaller 7"x7" footing which is more appropriate and allows for some precast concrete solutions.

· Table R507.4 Maximum Deck Post Height –the table is based now on tributary area 40,50,60, and 70 psf loading.

· Table R507.5(1) Maximum Deck Beam Span was replaced with four new tables R507.5(1) – (4) to account for the 40, 50, 60, and 70 psf loading. Section R507.5.2 now includes information that was previously in a footnote. The load from tributary areas are altered to reflect joists and beams with cantilevers.

· Table R507.6 Maximum Deck Joist Spans was amended to account for the 40, 50, 60, and 70 psf loading. The formatting of the table is significantly altered to clarify common confusion on allowable cantilevers. Previously, the table gave the allowable cantilever in terms of joist spacing. Since the assumed main span was the allowable span for that spacing, the maximum cantilevers sometimes became smaller as joist spacing became tighter. The new format has the cantilevers be more accurately based upon the main span. The previous table included a cantilever limit of ¼ the main span, and this limit is preserved. Where cantilevers are not permitted, the size of lumber is too small to support that main span.

· Table R507.9.1.3(1) Deck Ledger Connection to Band Joist - the table is based now on tributary area 40,50,60, and 70 psf loading, but uses the same empirical capacities from the original table.

Cost Impact: The code change proposal will increase the cost of construction
In those parts of the country where the ground snow load exceeds 40 psf, it could be assumed that there would be an increased cost of construction if the local jurisdictions allowed decks to be built with a lesser live load than the ground snow load might warrant for their areas. However, by adding 50,60, and 70 psf to the prescriptive tables, some builders may save money by eliminating the cost of engineering that might otherwise be required.

For the other ninety percent of the country, there would not be an anticipated increased cost of construction, in fact there could be a reduced cost for some situations where a smaller footing requirement may be applicable.

RB184-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There were multiple corrections expressed in a modification that the committee felt were too extensive. The wording in Section 507.4 is confusing. The committee urges that the corrections should be brought forward in a public comment. The collaborative effort, and inclusion of engineers in the effort, was a positive aspect for this proposal. (Vote: 10-1)

Assembly Action: **None**

RB184-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R507.3.1

Proponents:
Charles Bajnai, Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glennmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD[b] (psf)	TRIBUTARY AREA (sq. ft.)	~~LOAD BEARING VALUE OF SOILS~~ SOIL BEARING CAPACITY [a, c, d] (psf)										
		1500[e]			2000[e]			~~2500[e]~~			3000[e]	
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	~~Side of asquare footing (inches)~~	~~Diameter of around footing (inches)~~	~~Thickness (inches)~~	Side of a square footing (inches)	Diameter of a round footing (inches)
40	5	7	8	6	7	8	6				7	8
	20	~~12~~ 10	~~14~~ 12	6	~~12~~ 9	~~14~~ 10	6	~~12~~	~~14~~	~~6~~	~~12~~ 7	~~14~~ 8
	40	14	16	6	12	14	6	~~12~~	~~14~~	~~6~~	~~12~~ 10	~~14~~ 12
	60	17	19	6	15	17	6	~~13~~	~~15~~	~~6~~	12	14
	80	20	22	7	17	19	6	~~15~~	~~17~~	~~6~~	14	16
	100	22	25	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17
	120	24	27	9	21	23	7	~~19~~	~~21~~	~~6~~	17	19
	140	26	29	10	22	25	8	~~20~~	~~23~~	~~7~~	18	21
	160	28	31	11	24	27	9	~~21~~	~~24~~	~~8~~	20	22
50	5	7	8	6	7	8	6				7	8
	20	~~12~~ 11	~~14~~ 13	6	~~12~~ 10	~~14~~ 11	6	~~12~~	~~14~~	~~6~~	~~12~~ 8	~~14~~ 9
	40	15	17	6	13	15	6	~~12~~	~~14~~	~~6~~	~~12~~ 11	~~14~~ 13
	60	19	21	6	16	18	6	~~14~~	~~16~~	~~6~~	13	15
	80	21	24	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17
	100	24	27	9	21	23	7	~~19~~	~~21~~	~~6~~	17	19
	120	26	30	10	23	26	8	~~20~~	~~23~~	~~7~~	19	21
	140	28	32	11	25	28	9	~~22~~	~~25~~	~~8~~	20	23
	160	30	34	12	26	30	10	~~24~~	~~27~~	~~9~~	21	24
60	5	7	8	6	7	8	6				7	8
	20	12	14	6	~~12~~ 11	~~14~~ 12	6	~~12~~	~~14~~	~~6~~	~~12~~ 9	~~14~~ 10
	40	16	19	6	14	16	6	~~13~~	~~14~~	~~6~~	12	14
	60	20	23	7	17	20	6	~~16~~	~~18~~	~~6~~	14	16
	80	23	26	9	20	23	7	~~18~~	~~20~~	~~6~~	16	19
	100	26	29	10	22	25	8	~~20~~	~~23~~	~~7~~	18	21
	120	28	32	11	25	28	9	~~22~~	~~25~~	~~8~~	20	23
	140	31	35	12	27	30	10	~~24~~	~~27~~	~~9~~	22	24
	160	33	37	13	28	32	11	~~25~~	~~29~~	~~10~~	23	26
70	5	7	8	6	7	8	6				7	8
	20	12	14	6	~~12~~ 11	~~14~~ 13	6	~~12~~	~~14~~	~~6~~	~~12~~ 9	~~14~~ 10
	40	18	20	6	15	17	6	~~14~~	~~15~~	~~6~~	12	14
	60	21	24	8	19	21	6	~~17~~	~~19~~	~~6~~	15	17
	80	25	28	9	21	24	8	~~19~~	~~22~~	~~7~~	18	20
	100	28	31	11	24	27	9	~~21~~	~~24~~	~~8~~	20	22
	120	30	34	12	26	30	10	~~24~~	~~27~~	~~9~~	21	24
	140	33	37	13	28	32	11	~~25~~	~~29~~	~~10~~	23	26
	160	35	40	15	30	34	12	~~27~~	~~31~~	~~11~~	25	28

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.

b. Based on highest load case: Dead + Live or Dead + Snow.

c. ~~Assumes minimum square footing to be 12 inches x 12 inches x 6 inches for 6 x 6 post.~~ Footing dimensions shall allow complete bearing of the post.

d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.

e. Area, in square feet, of deck surface supported by post and footings.

f. Minimum thickness shall only apply to plain concrete footings.

Commenter's Reason: The Deck Code Coalition submits this public comment to amend and increase the functionality of Table R507.3.1.

1. It makes small editorial changes and corrections to the table.
2. It increases footings table to include tributary areas of 5 square feet, which is common for stair landings and also provides a lower bound for interpolation in the table.
3. Removes three columns for 2500 psf soil bearing capacity, because these values can be easily determined by interpolation.
4. Changes the minimum allowed footing from 12"x 12" or 14" in diameter to a more reasonable 7" x 7" or 8" in diameter.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This will allow for smaller footings where appropriate.

Staff Analysis: There are four public comments to RB184, three which as for replacements of parts of the proposal, and on asking for as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1132

Public Comment 2:

IRC®: R507.4, TABLE R507.4

Proponents:
Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glennmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R507.4 Deck posts. For single-level ~~wood-framed~~ decks ~~with beams sized in accordance with Table R507.5~~, wood deck post size shall be in accordance with Table R507.4.

TABLE R507.4
MAXIMUM DECK POST HEIGHT[a]

~~DECK POST SIZE~~	~~MAXIMUM HEIGHT[a, b] (feet-inches)~~
~~4 × 4~~	~~6-9[e]~~
~~4 × 6~~	~~8~~
~~6 × 6~~	~~14~~
~~8 × 8~~	~~14~~

POST SPECIES[c]	NOMINAL POST SIZE[d]	MAXIMUM DECK POST HEIGHT [a,b] (feet-inches) Tributary Area (sqft)							
		20	40	60	80	100	120	140	160
Southern Pine	4x4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2
	4x6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2
	6x6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
Douglas Fir[e], Hem- Fir[e], SPF[e]	4x4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3
	4x6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10
	6x6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
Redwood[f], Western Cedars[f], Ponderosa Pine[f], Red Pine[f]	4x4	14-0	13-2	10-3	8-1	5-8	NP	NP	NP
	4x6	14-0	14-0	13-6	11-4	9-9	8-4	6-9	4-7
	6x6	14-0	14-0	14-0	14-0	14-0	14-0	13-7	9-7
	8x8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa. NP=Not permitted

a. Measured to the underside of the beam from top of footing or pier.
b. Based on 40 psf live load.
c. ~~The maximum permitted height is 8 feet for one-ply and two-ply beams. The maximum permitted height for three-ply beams on post cap is 6 feet 9 inches.~~ No. 2 grade, wet service factor included.
d. Notched posts shall be sized to accommodate beam size in accordance with Section R507.5.2
e. Includes incising factor.
f. Incising factor not included.

Commenter's Reason: The Deck Code Coalition submits this public comment to increase the functionality of Table R507.4 by expanding it based on *wood species* and *tributary area*.
It does not take into consideration snow loading that the original proposal RB184-19 was intended to do.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment gives the values for post heights calculated per the NDS, so while there are a few instances where allowable post height is decreased, these values are more accurate than the current table.

Staff Analysis: There are four public comments to RB184, three which as for replacements of parts of the proposal, and on asking for as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1160

Public Comment 3:

IRC®: R507.6, TABLE R507.6

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glennmathewson.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7. ~~The maximum joist cantilever shall be limited to one-fourth of the joist span or the maximum cantilever length specified in Table R507.6, whichever is less.~~

TABLE R507.6
MAXIMUM DECK JOIST SPANS ~~FOR COMMON LUMBER SPECIES (ft. - in.)~~

SPECIES[a]	SIZE	ALLOWABLE JOIST SPAN[b, c] (feet-inches)			MAXIMUM CANTILEVER[~~c,~~ f, g] (feet-inches)								
		~~Spacing of~~ Deck Joist Spacing (inches)			~~SPACING OF DECK JOISTS WITH CANTILEVERS[c] (inches)~~ Joist Back Span[f] (feet)								
		12	16	24	4	6	8	10	12	14	16	18	24
Southern pine	2 × 6	9-11	9-0	7-7	1-0	1-6	1-5	NP	~~1-3~~ NP	NP	~~1-4~~ NP	NP	~~1-6~~
	2 × 8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	~~2-1~~ 2-3	NP	~~2-3~~ NP	NP	~~2-5~~
	2 × 10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	~~3-4~~ 3-0	3-4	~~3-6~~ 3-4	NP	~~2-10~~
	2 × 12	18-0	16-6	13-6	1-0	1-6	2-0	2-6	~~4-6~~ 3-0	3-6	~~4-2~~ 4-0	4-1	~~3-4~~
Douglas fir-larch[d], hem-fir[d] spruce-pine-fir[d],	2 × 6	9-6	~~8-8~~ 8-4	~~7-2~~ 6-10	1-0	1-6	1-4	NP	~~1-2~~ NP	NP	~~1-3~~ NP	NP	~~1-5~~
	2 × 8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	~~1-11~~ 2-0	NP	~~2-1~~ NP	NP	~~2-3~~
	2 × 10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	~~3-1~~ 3-0	3-3	~~3-5~~ NP	NP	~~2-9~~
	2 × 12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	~~4-6~~ 3-0	3-6	3-11	3-11	~~3-3~~
Redwood, western cedars, ponderosa pine[e], red pine[e]	2 × 6	8-10	8-0	~~7-0~~ 6-10	1-0	1-4	1-1	NP	~~1-0~~ NP	NP	~~1-1~~ NP	NP	~~1-2~~
	2 × 8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	~~1-8~~ NP	NP	~~1-10~~ NP	NP	~~2-0~~
	2 × 10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	~~2-8~~ 3-0	2-9	~~2-10~~ NP	NP	~~2-8~~
	2 × 12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	~~3-10~~ 3-0	3-6	~~3-9~~ 3-8	NP	~~3-1~~

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not permitted

a. No. 2 grade with wet service factor.

b. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360.

c. Ground snow load, live load = 40 psf, dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever with a 220-pound point load applied to end.

d. Includes incising factor.

e. Northern species with no incising factor.

f. Cantilevered spans not exceeding the nominal depth of the joist are permitted. Interpolation permitted. Extrapolation is not permitted.

g. L/Δ = 180 at cantilever with 220-pound point load applied to end.

Commenter's Reason: The Deck Code Coalition submits this public comment to correct a few errors and make Table R507.6 easier to understand. It does not take into consideration snow loading that the original RB184-19 was intended to do.
The table is changed from the 2018 IRC by adding adjacent joist spans (i.e. back spans) the allowable cantilever based upon the joist spacing and calculated with the assumption that the adjacent span is the full length allowed. Since the allowable cantilever is more dependent upon the adjacent joist back span than on the joist spacing, the table should be easier to use.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This new format will allow for longer and more accurate cantilever lengths.

Staff Analysis: There are four public comments to RB184, three which as for replacements of parts of the proposal, and on asking for as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1163

Public Comment 4:

IRC®: TABLE R507.3.1, R507.4, TABLE R507.4, ABLE R507.5(1), TABLE R507.5(2) (New), TABLE R507.5(3) (New), TABLE R507.5(4) (New), TABLE R507.6, TABLE R507.9.1.3(1)

Proponents:

Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com); Glenn Mathewson, representing North American Deck and Railing Association (glenn@glennmathewson.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS

LIVE OR GROUND SNOW LOAD[b] (psf)	TRIBUTARY AREA[e] (sq. ft.)	SOIL BEARING CAPACITY[a, c, d] 1500 psf			2000 psf			≥ 3000 psf		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness[f] (inches)
40	5	7	8	6	7	8	6	7	8	6
	20	10	~~10~~ 12	6	9	9	6	7	8	6
	40	14	~~14~~ 16	~~7~~ 6	12	~~13~~ 14	6	10	~~10~~ 12	6
	60	17	~~18~~ 19	~~9~~ 6	15	~~15~~ 17	~~8~~ 6	12	~~13~~ 14	6
	80	20	22	7	17	19	6	14	16	6
	100	22	25	8	19	21	6	15	17	6
	120	24	27	9	21	23	7	17	19	6
	140	26	29	10	22	25	8	18	21	6
	160	28	31	11	24	27	9	20	22	7
50	5	7	8	6	7	8	6	7	8	6
	20	11	~~12~~ 13	6	10	~~10~~ 11	6	8	~~8~~ 9	6
	40	~~16~~ 15	~~16~~ 17	6	~~8~~ 13	~~14~~ 15	6	11	~~12~~ 13	6
	60	19	21	6	16	18	6	13	15	6
	80	21	24	8	19	21	6	15	17	6
	100	24	27	9	21	23	7	17	19	6
	120	26	30	10	23	26	8	19	21	6
	140	28	32	11	25	28	9	20	23	7
	160	30	34	12	26	30	10	21	24	8
60	5	7	8	6	7	8	6	7	8	6
	20	12	~~13~~ 14	6	11	~~11~~ 12	6	9	~~9~~ 10	6
	40	~~17~~ 16	~~18~~ 19	6	~~15~~ 14	~~15~~ 16	8	12	~~13~~ 14	6
	60	20	23	7	17	20	6	14	16	6
	80	23	26	9	20	23	7	16	19	6
	100	26	29	10	22	25	8	18	21	6
	120	28	32	11	25	28	9	20	23	7
	140	31	35	12	27	30	10	22	24	8
	160	33	37	13	28	32	11	23	26	9
70	5	7	8	6	7	8	6	7	8	6
	20	~~13~~ 12	14	7 6	11	~~12~~ 13	6	9	10	6
	40	18	~~19~~ 20	~~9~~ 6	~~16~~ 15	17	~~8~~ 6	~~13~~ 12	14	~~7~~ 6
	60	21	24	8	19	21	6	15	17	6
	80	25	28	9	21	24	8	18	20	6
	100	28	31	11	24	27	9	20	22	7
	120	30	34	12	26	30	10	21	24	8
	140	33	37	13	28	32	11	23	26	9
	160	35	40	15	30	34	12	25	28	9

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted, extrapolation not permitted.

b. Based on highest load case: Dead + Live or Dead + Snow.

c. Footing dimensions shall allow complete bearing of the post.

d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.

e. Area, in square feet, of deck surface supported by post and footings.

f. Minimum thickness shall only apply to plain concrete footings.

R507.4 Deck posts. For single-level decks, wood ~~deck~~ post size shall be in accordance with Table R507.4.

TABLE R507.4
DECK POST HEIGHT

Portions of table not shown remain unchanged.

LOADS [b] (psf)	POST SPECIES [c]	POST SIZE [d]	~~TRIBUTARY AREA [g, h] (sqft)~~ MAXIMUM DECK POST HEIGHT [a] (feet-inches) Tributary Area [g,h] (sqft)							
			20	40	60	80	100	120	140	160
40 Live Load	Southern Pine	4 x 4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2
		4 x 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2
		6 x 6	14-0	14-0	~~11-0~~ 14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3
		4 x 6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	4 x 4	14-0	~~12-1~~ 13-2	~~9-8~~ 10-3	~~8-22~~ 8-1	~~7-1~~ 5-8	~~6-2~~ NP	~~5-3~~ NP	~~4-2~~ NP
		4 x 6	14-0	14-0	~~12-4~~ 13-6	~~10-7~~ 11-4	~~9-4~~ 9-9	8-4	~~7-7~~ 6-9	~~6-11~~ 4-7
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	~~14-0~~ 13-7	~~12-10~~ 9-7
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
50 Ground Snow Load	Southern Pine	4 x 4	14-0	12-2	9-10	8-5	7-5	~~9-7~~ 6-7	5-11	5-4
		4 x 6	14-0	14-0	12-6	10-9	9-6	8-7	7-10	7-3
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	13-4
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	12-1	9-8	8-2	7-1	6-2	5-3	4-2
		4 x 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	4 x 4	14-0	11-8	9-0	6-10	3-7	NP	NP	NP
		4 x 6	14-0	14-0	12-0	10-0	8-6	7-0	5-3	NP
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Southern Pine	4 x 4	14-0	11-1	8-11	7-7	6-7	5-10	5-2	4-6
		4 x 6	14-0	14-0	11-4	9-9	8-7	7-9	7-1	6-6
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-9	11-2
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir [e],	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NP

60 Ground Snow Load	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	10-11	8-8	7-3	6-2	5-0	3-7	NP
		4 x 6	14-0	13-11	~~112-~~ 11-2	9-7	8-4	7-5	6-8	5-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	14-0	12-2	10-2
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars f, Ponderosa Pine f, Red Pine f	4 x 4	14-0	10-6	7-9	4-7	NP	NP	NP	NP
		4 x 6	14-0	13-7	10-9	8-9	7-0	4-9	NP	NP
		6 x 6	14-0	14-0	14-0	14-0	14-0	9-9	NP	NP
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
70 Ground Snow Load	Southern Pine	4 x 4	14-0	10-2	8-2	6-11	5-11	5-2	4-4	3-4
		4 x 6	14-0	12-11	10-5	8-11	7-10	7-1	6-5	5-10
		6 x 6	14-0	14-0	14-0	14-0	14-0	12-9	10-11	8-7
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas Fir [e], Hem-fir [e], SPF [e]	4 x 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
		4 x 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
		6 x 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood [f], Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	4 x 4	14-0	9-5	6-5	NP	NP	NP	NP	NP
		4 x 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP
		6 x 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		8 x 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa., NP = Not Permitted

a. Measured from the underside of the beam to top of footing or pier.

b. 10 psf dead load. Snow load not assumed to be concurrent with live load.

c. No. 2 grade, wet service factor included.

d. Notched deck posts shall be sized to accommodate beam size per in accordance with Section R507.5.2

e. Includes incising factor.

f. Incising factor not included.

g. Area, in square feet, of deck surface supported by post and footings.

h. Interpolation permitted. Extrapolation not permitted.

ABLE R507.5(1)
MAXIMUM DECK BEAM SPAN - 40 PSF LIVE LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	~~DECK JOIST SPAN [a, i] (feet)~~ MAXIMUM BEAM SPAN [a,b,f] (feet-inches) Deck Joist Span [a,i] (feet)						
		6	8	10	12	14	16	18
Southern Pine	1 – 2 × 6	4-7	4-0	3-7	3-3	3-0	2-10	~~2-7~~ 2-8
	1 – 2 × 8	~~5-10~~ 5-11	5-1	~~4-6~~ 4-7	~~4-1~~ 4-2	3-10	3-7	~~3-4~~ 3-5
	1 – 2 × 10	~~6-11~~ 7-0	6-0	~~5-4~~ 5-5	4-11	~~4-6~~ 4-7	4-3	4-0
	1 – 2 × 12	~~8-2~~ 8-3	7-1	6-4	~~5-9~~ 5-10	~~5-4~~ 5-5	5-0	~~4-8~~ 4-9
	2 – 2 × 6	~~6-10~~ 6-11	5-11	~~5-3~~ 5-4	4-10	4-6	~~4-2~~ 4-3	~~3-11~~ 4-0
	2 – 2 × 8	~~8-8~~ 8-9	~~7-6~~ 7-7	6-9	6-2	~~5-8~~ 5-9	5-4	5-0
	2 – 2 × 10	10-4	~~8-11~~ 9-0	8-0	~~7-3~~ 7-4	6-9	6-4	~~5-11~~ 6-0
	2 – 2 × 12	12-2	~~10-6~~ 10-7	9-5	8-7	~~7-11~~ 8-0	7-5	7-0
	3 – 2 × 6	8-6	7-5	6-8	6-1	~~5-7~~ 5-8	5-3	4-11
	3 – 2 × 8	10-11	~~9-5~~ 9-6	~~8-5~~ 8-6	~~7-8~~ 7-9	~~7-1~~ 7-2	6-8	~~6-3~~ 6-4
	3 – 2 × 10	~~12-11~~ 13-0	11-2	10-0	~~9-1~~ 9-2	~~8-5~~ 8-6	7-11	~~7-5~~ 7-6
	3 – 2 × 12	15-3	~~13-2~~ 13-3	~~11-9~~ 11-10	10-9	~~9-11~~ 10-0	9-4	~~8-9~~ 8-10
Douglas fir-larch [g], Hem-fir [g], Spruce-pine-fir [g],	1– 2 x 6	4-1	3-6	3-0	~~2-6~~ 2-8	~~2-1~~ 2-5	~~1-10~~ 2-3	~~1-7~~ 2-1
	1–2 × 8	5-6	~~4-9~~ 4-8	4-0	~~3-3~~ 3-6	~~2-9~~ 3-2	~~2-5~~ 2-11	~~2-1~~ 2-9
	1– 2 × 10	6-8	5-10	5-1	~~4-2~~ 4-6	~~3-6~~ 4-1	~~3-1~~ 3-9	~~2-8~~ 3-6
	1– 2 × 12	7-9	6-9	6-0	~~5-1~~ 5-6	~~4-4~~ 5-0	3-9	~~3-3~~ 3-6
	2-2 x 6	6-1	5-3	4-9	4-4	~~4-0~~ 3-11	~~3-8~~ 3-7	3-3
	2-2 x 8	8-2	7-1	6-4	5-9	~~5-4~~ 5-2	~~4-10~~ 4-8	~~4-3~~ 4-4
	2-2 x 10	10-0	8-7	7-9	7-0	6-6	~~6-1~~ 6-0	~~5-5~~ 5-6
	2-2 x 12	11-7	10-0	8-11	8-2	7-7	7-1	~~6-7~~ 6-8
	3 – 2 × 6	7-8	~~6-7~~ 6-8	~~5-11~~ 6-0	~~5-5~~ 5-6	~~5-0~~ 5-1	~~4-8~~ 4-9	~~4-5~~ 4-6
	3 – 2 × 8	10-3	8-10	7-11	7-3	6-8	6-3	5-11
	3 – 2 × 10	12-6	10-10	9-8	8-10	8-2	7-8	7-2
	3 – 2 × 12	14-6	12-7	11-3	10-3	9-6	8-11	8-5
Redwood [h], Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	1 - 2 x 6	4-2	3-7	3-1	~~2-7~~ 2-9	~~2-2~~ 2-6	~~1-10~~ 2-3	~~1-8~~ 2-2
	1 - 2 x 8	5-4	4-7	4-1	~~3-4~~ 3-7	~~2-10~~ 3-3	~~2-6~~ 3-0	~~2-2~~ 2-10
	1 - 2 x 10	6-6	5-7	5-0	~~4-3~~ 4-7	~~3-8~~ 4-2	~~3-2~~ 3-10	~~2-9~~ 3-7
	1 - 2 x 12	7-6	6-6	5-10	~~5-3~~ 5-4	~~4-5~~ 4-11	~~3-10~~ 4-7	~~3-5~~ 4-4
	2 - 2 x 6	6-2	5-4	4-10	4-5	~~4-1~~ 4-0	~~3-9~~ 3-8	3-4
	2 - 2 x 8	7-10	6-10	6-1	5-7	5-2	4-10	~~4-4~~ 4-5
	2 - 2 x10	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	2 - 2 x 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5
	3 - 2 x 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6
	3 - 2 x 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8
	3 - 2 x 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3 - 2 x 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation permitted. Extrapolation not permitted.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor.

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(2)
MAXIMUM DECK BEAM SPAN - 50 PSF GROUND SNOW LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	~~DECK JOIST SPAN [a,i]~~ MAXIMUM BEAM SPAN [a,b,f] (feet-inches) Deck Joist Span [a,i] (feet)						
		6	8	10	12	14	16	18
Southern Pine	1-2x6	~~4-2~~ 4-6	~~3-8~~ 3-11	~~3-3~~ 3-6	~~2-11~~ 3-2	~~2-9~~ 2-11	~~2-5~~ 2-9	~~2-2~~ 2-7
	1-2x8	~~5-4~~ 5-9	~~4-7~~ 4-11	~~4-1~~ 4-5	~~3-9~~ 4-0	~~3-6~~ 3-9	~~3-3~~ 3-6	~~2-10~~ 3-3
	1-2x10	~~6-4~~ 6-9	~~5-6~~ 5-10	~~4-11~~ 5-3	~~4-6~~ 4-9	~~4-2~~ 4-5	~~3-10~~ 4-2	~~3-8~~ 3-11
	1-2x12	~~7-6~~ 8-0	~~6-5~~ 6-11	~~5-9~~ 6-2	~~5-3~~ 5-8	~~4-10~~ 5-3	~~4-7~~ 4-11	~~4-3~~ 4-7
	2-2x6	~~6-3~~ 6-8	~~5-5~~ 5-9	~~4-10~~ 5-2	~~4-5~~ 4-9	~~4-1~~ 4-4	~~3-10~~ 4-1	~~3-7~~ 3-10
	2-2x8	~~7-11~~ 8-6	~~6-10~~ 7-4	~~6-2~~ 6-7	~~5-7~~ 6-0	~~5-2~~ 5-7	~~4-10~~ 5-2	~~4-7~~ 4-11
	2-2x10	~~9-5~~ 10-1	~~8-2~~ 8-9	~~7-3~~ 7-10	~~6-8~~ 7-1	~~6-2~~ 6-7	~~5-9~~ 6-2	~~5-5~~ 5-10
	2-2x12	~~11-1~~ 11-11	~~9-7~~ 10-3	~~8-7~~ 9-2	~~7-10~~ 8-5	~~7-3~~ 7-9	~~6-9~~ 7-3	~~6-5~~ 6-10
	3-2x6	~~7-10~~ 7-11	~~6-9~~ 7-2	~~6-1~~ 6-6	~~5-6~~ 5-11	~~5-1~~ 5-6	~~4-9~~ 5-1	~~4-6~~ 4-10
	3-2x8	~~9-11~~ 10-5	~~8-7~~ 9-3	~~7-8~~ 8-3	~~7-0~~ 7-6	~~6-6~~ 6-11	~~6-16~~ 6-6	~~5-9~~ 6-2
	3-2x10	~~11-9~~ 12-8	~~10-2~~ 10-11	~~9-1~~ 9-9	~~8-4~~ 8-11	~~7-8~~ 8-3	~~7-2~~ 7-9	~~6-9~~ 7-3
	3-2x12	~~13-11~~ 14-11	~~12-0~~ 12-11	~~10-9~~ 11-6	~~9-10~~ 10-6	~~9-1~~ 9-9	~~8-6~~ 9-1	~~8-0~~ 8-7
Douglas fir-larch [g], Hem-fir [g], Spruce-pine-fir [g]	1-2x6	~~3-9~~ 4-0	~~3-3~~ 3-5	~~2-6~~ 2-11	~~2-1~~ 2-7	~~1-9~~ 2-4	~~1-6~~ 2-2	~~1-4~~ 2-0
	1-2x8	~~5-0~~ 5-4	~~4-3~~ 4-7	~~3-4~~ 3-11	~~2-9~~ 3-5	~~2-3~~ 3-1	~~2-0~~ 2-10	~~1-9~~ 2-8
	1-2x10	~~6-1~~ 6-7	~~5-4~~ 5-8	~~4-3~~ 4-11	~~3-6~~ 4-5	~~2-11~~ 4-0	~~2-6~~ 3-8	~~2-3~~ 3-5
	1-2x12	~~7-1~~ 7-7	~~6-2~~ 6-7	~~5-2~~ 5-11	~~4-3~~ 5-4	~~3-7~~ 4-10	~~3-1~~ 4-6	~~2-9~~ 4-2
	2-2x6	~~5-7~~ 6-0	~~4-10~~ 5-2	~~4-4~~ 4-7	~~3-11~~ 4-2	~~3-6~~ 3-10	~~3-0~~ 3-5	~~2-8~~ 3-2
	2-2x8	~~7-5~~ 8-0	~~6-5~~ 6-11	~~5-9~~ 6-2	~~5-3~~ 5-8	~~4-7~~ 5-0	~~4-0~~ 4-7	~~3-6~~ 4-2
	2-2x10	~~9-1~~ 9-9	~~7-10~~ 8-5	~~7-0~~ 7-7	~~6-5~~ 6-11	~~5-11~~ 6-4	~~5-1~~ 5-10	~~4-6~~ 5-4
	2-2x12	~~10-7~~ 11-4	~~9-2~~ 9-10	~~8-2~~ 8-9	~~7-5~~ 8-0	~~6-11~~ 7-5	~~6-3~~ 6-11	~~5-6~~ 6-6
	3-2x6	~~7-0~~ 7-6	~~6-0~~ 6-6	~~5-5~~ 5-9	~~4-11~~ 5-3	~~4-7~~ 4-11	~~4-3~~ 4-7	~~4-0~~ 4-4
	3-2x8	~~9-4~~ 10-0	~~8-1~~ 8-8	~~7-3~~ 7-9	~~6-7~~ 7-1	~~6-1~~ 6-6	~~5-8~~ 6-1	~~5-4~~ 5-8
	3-2x10	~~11-5~~ 12-3	~~9-10~~ 10-7	~~8-10~~ 9-6	~~8-1~~ 8-8	~~7-5~~ 8-0	~~7-0~~ 7-6	~~6-7~~ 7-0
	3-2x12	~~13-3~~ 14-3	~~11-6~~ 12-4	~~10-3~~ 11-0	~~9-5~~ 10-1	~~8-8~~ 9-4	~~8-1~~ 8-9	~~7-8~~ 8-3
Redwood [h], Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	1-2x6	~~3-10~~ 4-1	~~3-4~~ 3-6	~~2-7~~ 3-0	~~2-2~~ 2-8	~~1-10~~ 2-5	~~1-7~~ 2-3	~~1-5~~ 2-1
	1-2x8	~~4-10~~ 5-2	~~4-2~~ 4-6	~~3-5~~ 4-0	~~2-10~~ 3-6	~~2-4~~ 3-2	~~2-1~~ 2-11	~~1-10~~ 2-9
	1-2x10	~~5-11~~ 6-4	~~5-1~~ 5-6	~~4-4~~ 4-11	~~3-7~~ 4-6	~~3-0~~ 4-1	~~2-8~~ 3-9	~~2-4~~ 3-6
	1-2x12	~~6-10~~ 7-4	~~5-11~~ 6-4	~~5-4~~ 5-8	~~4-4~~ 5-2	~~3-8~~ 4-10	~~3-2~~ 4-6	~~2-10~~ 4-3
	2-2x6	~~5-8~~ 6-1	~~4-11~~ 5-3	~~4-5~~ 4-8	~~4-0~~ 4-4	~~3-7~~ 3-11	~~3-1~~ 3-6	~~2-9~~ 3-3
	2-2x8	~~7-2~~ 7-8	~~6-3~~ 6-8	~~5-7~~ 5-11	~~5-1~~ 5-5	~~4-8~~ 5-0	~~4-1~~ 4-8	~~3-8~~ 4-3
	2-2x10	~~8-9~~ 9-5	~~7-7~~ 8-2	~~6-9~~ 7-3	~~6-2~~ 6-8	~~5-9~~ 6-2	~~5-3~~ 5-9	~~4-8~~ 5-5
	2-2x12	~~10-2~~ 10-11	~~8-10~~ 9-5	~~7-10~~ 8-5	~~7-2~~ 7-8	~~6-8~~ 7-2	~~6-3~~ 6-8	~~5-8~~ 6-3
	3-2x6	7-1	~~6-2~~ 6-5	~~5-6~~ 5-11	~~5-0~~ 5-5	~~4-8~~ 5-0	~~4-4~~ 4-8	~~4-1~~ 4-5
	3-2x8	~~9-0~~ 9-4	~~7-9~~ 8-4	~~6-11~~ 7-5	~~6-4~~ 6-10	~~5-11~~ 6-4	~~5-6~~ 5-11	~~5-2~~ 5-7
	3-2x10	~~11-0~~ 11-9	~~9-6~~ 10-2	~~8-6~~ 9-1	~~7-9~~ 8-4	~~7-2~~ 7-8	~~6-9~~ 7-2	~~6-4~~ 6-9
	3-2x12	~~12-9~~ 13-8	~~11-0~~ 11-10	~~9-10~~ 10-7	~~9-0~~ 9-8	~~8-4~~ 8-11	~~7-9~~ 8-4	~~7-4~~ 7-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(3)
MAXIMUM DECK BEAM SPAN - 60 PSF GROUND SNOW LOAD [c]

Portions of table not shown remain unchanged.

BEAM SPECIES [d]	BEAM SIZE [e]	~~DECK JOIST SPAN [a, h] (feet)~~ MAXIMUM BEAM SPAN [a,b,f] (feet-inches)						
		Deck Joist Span [a,i] (feet)						
		6	8	10	12	14	16	18
Southern Pine	1-2x6	~~3-11~~ 4-2	~~3-4~~ 3-7	~~3-0~~ 3-3	~~2-9~~ 2-11	~~2-5~~ 2-9	~~2-1~~ 2-6	~~1-10~~ 2-5
	1-2x8	~~4-11~~ 5-3	~~4-3~~ 4-7	~~3-10~~ 4-1	~~3-6~~ 3-9	~~3-2~~ 3-5	~~2-9~~ 3-3	~~2-5~~ 3-0
	1-2x10	~~5-10~~ 6-3	~~5-1~~ 5-5	~~4-6~~ 4-10	~~4-2~~ 4-5	~~3-10~~ 4-1	~~3-6~~ 3-10	~~3-1~~ 3-7
	1-2x10	~~6-11~~ 7-5	~~6-0~~ 6-5	~~5-4~~ 5-9	~~4-10~~ 5-3	~~4-6~~ 4-10	~~4-3~~ 4-6	~~3-10~~ 4-3
	2-2x6	~~5-9~~ 6-2	~~5-0~~ 5-4	~~4-6~~ 4-9	~~4-1~~ 4-4	~~3-9~~ 4-0	~~3-6~~ 3-9	~~3-4~~ 3-7
	2-2x8	~~7-4~~ 7-10	~~6-4~~ 6-10	~~5-8~~ 6-1	~~5-2~~ 5-7	~~4-9~~ 5-2	~~4-6~~ 4-10	~~4-3~~ 4-6
	2-2x10	~~8-8~~ 9-4	~~7-6~~ 8-1	~~6-9~~ 7-3	~~6-2~~ 6-7	~~5-8~~ 6-1	~~5-4~~ 5-8	~~5-0~~ 5-4
	2-2x12	~~10-3~~ 11-0	~~8-11~~ 9-6	~~7-11~~ 8-6	~~7-3~~ 7-9	~~6-8~~ 7-2	~~6-3~~ 6-9	~~5-11~~ 6-4
	3-2x6	~~7-3~~ 7-5	~~6-3~~ 6-9	~~5-7~~ 6-0	~~5-1~~ 5-6	~~4-9~~ 5-1	~~4-5~~ 4-9	~~4-2~~ 4-6
	3-2x8	~~9-2~~ 9-9	~~7-11~~ 8-6	~~7-1~~ 7-8	~~6-6~~ 6-11	~~6-0~~ 6-5	~~5-7~~ 6-0	~~5-3~~ 5-8
	3-2x10	~~10-11~~ 11-8	~~9-5~~ 10-2	~~8-5~~ 9-1	~~7-8~~ 8-3	~~7-2~~ 7-8	~~6-8~~ 7-2	~~6-3~~ 6-9
	3-2x12	~~12-10~~ 13-9	~~11-2~~ 11-11	~~9-11~~ 10-8	~~9-1~~ 9-9	~~8-5~~ 9-0	~~7-10~~ 8-5	~~7-5~~ 7-11
Douglas fir-larch [g], Hem-fir [g], Spruce-pine-fir [g]	1-2x6	~~3-5~~ 3-8	~~2-9~~ 3-1	~~2-2~~ 2-8	~~1-9~~ 2-4	~~1-6~~ 2-2	~~1-3~~ 2-0	~~1-1~~ 1-10
	1-2x8	~~4-8~~ 5-0	~~3-8~~ 4-1	~~2-10~~ 3-6	~~2-4~~ 3-1	~~1-11~~ 2-10	~~1-8~~ 2-7	~~1-6~~ 2-5
	1-2x10	~~5-8~~ 6-1	~~4-8~~ 5-2	~~3-8~~ 4-6	~~3-0~~ 4-0	~~2-6~~ 3-7	~~2-2~~ 3-4	~~1-11~~ 3-2
	1-2x12	~~6-7~~ 7-1	~~5-8~~ 6-1	~~4-5~~ 5-5	~~3-7~~ 4-10	~~3-1~~ 4-5	~~2-7~~ 4-1	~~2-3~~ 3-10
	2-2x6	~~5-2~~ 5-6	~~4-5~~ 4-9	~~4-0~~ 4-3	~~3-6~~ 3-10	~~3-0~~ 3-5	~~1-11~~ 3-1	~~1-8~~ 2-10
	2-2x8	~~6-11~~ 7-5	~~5-11~~ 6-5	~~5-4~~ 5-9	~~4-8~~ 5-0	~~3-11~~ 4-6	~~3-5~~ 4-1	~~3-0~~ 3-9
	2-2x10	~~8-5~~ 9-0	~~7-3~~ 7-10	~~6-6~~ 7-0	~~5-11~~ 6-4	~~5-1~~ 5-9	~~4-5~~ 5-2	~~3-10~~ 4-10
	2-2x12	~~9-9~~ 10-6	~~8-5~~ 9-1	~~7-7~~ 8-1	~~6-11~~ 7-5	~~6-2~~ 6-10	~~5-4~~ 6-4	~~4-8~~ 5-10
	3-2x6	~~6-5~~ 6-11	~~5-7~~ 6-0	~~5-0~~ 5-4	~~4-7~~ 4-11	~~4-3~~ 4-6	~~3-11~~ 4-2	~~3-5~~ 3-10
	3-2x8	~~8-8~~ 9-3	~~7-6~~ 8-0	~~6-8~~ 7-2	~~6-1~~ 6-6	~~5-8~~ 6-1	~~5-2~~ 5-6	~~4-7~~ 5-0
	3-2x10	~~10-7~~ 11-4	~~9-2~~ 9-10	~~8-2~~ 8-9	~~7-5~~ 8-0	~~6-11~~ 7-5	~~6-5~~ 6-11	~~5-10~~ 6-5
	3-2x12	~~12-3~~ 13-2	~~10-8~~ 11-5	~~9-6~~ 10-2	~~8-8~~ 9-4	~~8-0~~ 8-7	~~7-6~~ 8-1	~~7-1~~ 7-7
Redwood [h], Western Cedars [h], Ponderosa Pine [h], Red Pine [h]	1-2x6	~~3-6~~ 3-9	~~2-10~~ 3-2	~~2-3~~ 2-9	~~1-10~~ 2-5	~~1-7~~ 2-2	~~1-4~~ 2-0	~~1-2~~ 1-11
	1-2x8	~~4-6~~ 4-10	~~3-9~~ 4-2	~~2-11~~ 3-7	~~2-5~~ 3-2	~~2-0~~ 2-11	~~1-9~~ 2-8	~~1-7~~ 2-6
	1-2x10	~~5-6~~ 5-10	~~4-9~~ 5-1	~~3-9~~ 4-6	~~3-1~~ 4-1	~~2-7~~ 3-8	~~2-3~~ 3-5	~~2-0~~ 3-3
	1-2x12	~~6-4~~ 6-10	~~5-6~~ 5-11	~~4-7~~ 5-3	~~3-9~~ 4-10	~~3-2~~ 4-5	~~2-9~~ 4-2	~~2-5~~ 3-11
	2-2x6	~~5-3~~ 5-7	~~4-6~~ 4-10	~~4-1~~ 4-4	~~3-8~~ 3-11	~~3-1~~ 3-6	~~2-8~~ 3-2	~~2-4~~ 2-11
	2-2x8	~~6-8~~ 7-1	~~5-9~~ 6-2	~~5-2~~ 5-6	~~4-8~~ 5-0	~~4-1~~ 4-7	~~3-6~~ 4-2	~~3-1~~ 3-10
	2-2x10	~~8-1~~ 8-8	~~7-0~~ 7-6	~~6-3~~ 6-9	~~5-9~~ 6-2	~~5-2~~ 5-8	~~4-6~~ 5-4	~~4-0~~ 4-11
	2-2x12	~~9-5~~ 10-1	~~8-2~~ 8-9	~~7-3~~ 7-10	~~6-8~~ 7-2	~~6-2~~ 6-7	~~5-6~~ 6-2	~~4-10~~ 5-10
	3-2x6	~~6-7~~ 6-8	~~5-8~~ 6-1	~~5-1~~ 5-5	~~4-8~~ 5-0	~~4-4~~ 4-7	~~4-0~~ 4-3	~~3-7~~ 3-11
	3-2x8	~~8-4~~ 8-9	~~7-2~~ 7-9	~~6-5~~ 6-11	~~5-11~~ 6-4	~~5-5~~ 5-10	~~5-1~~ 5-5	~~4-8~~ 5-2
	3-2x10	~~10-2~~ 10-11	~~8-10~~ 9-5	~~7-10~~ 8-5	~~7-2~~ 7-8	~~6-8~~ 7-2	~~6-3~~ 6-8	~~5-10~~ 6-3
	3-2x12	~~11-9~~ 12-8	~~10-2~~ 10-11	~~9-1~~ 9-9	~~8-4~~ 8-11	~~7-8~~ 8-3	~~7-3~~ 7-9	~~6-10~~ 7-3

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.5(4)
MAXIMUM DECK BEAM SPAN - 70 PSF GROUND SNOW LOAD [c]

BEAM SPECIES [d]	BEAM SIZE [e]	~~DECK JOIST SPAN (feet) [a, i]~~ MAXIMUM BEAM SPAN a,b,f (feet-inches)						
		Deck Joist Span [a,i] (feet)						
		6	8	10	12	14	16	18
Southern Pine	1-2x6	~~3-8~~ 3-11	~~3-2~~ 3-4	~~2-10~~ 3-0	~~2-1~~ 2-9	~~1-10~~ 2-6	~~1-4~~ 2-4	~~1-7~~ 2-3
	1-2x8	~~4-7~~ 4-11	~~4-0~~ 4-3	~~3-7~~ 3-10	~~3-3~~ 3-6	~~2-9~~ 3-3	~~2-5~~ 3-0	~~2-2~~ 2-10
	1-2x10	~~5-6~~ 5-10	~~4-9~~ 5-1	~~4-3~~ 4-6	~~3-10~~ 4-2	~~3-7~~ 3-10	~~3-1~~ 3-7	~~2-9~~ 3-4
	1-2x12	~~6-5~~ 6-11	~~5-7~~ 6-0	~~5-0~~ 5-4	~~4-7~~ 4-11	~~4-3~~ 4-6	~~3-9~~ 4-3	~~3-4~~ 4-0
	2-2x6	~~5-5~~ 5-9	~~4-8~~ 5-0	~~4-2~~ 4-6	~~3-10~~ 4-1	~~3-6~~ 3-9	~~3-3~~ 3-6	~~3-1~~ 3-4
	2-2x8	~~6-10~~ 7-4	~~5-11~~ 6-4	~~5-4~~ 5-8	~~4-10~~ 5-2	~~4-6~~ 4-10	~~4-2~~ 4-6	~~3-11~~ 4-3
	2-2x10	~~8-2~~ 8-9	~~7-1~~ 7-7	~~6-4~~ 6-9	~~5-9~~ 6-2	~~5-4~~ 5-8	~~5-0~~ 5-4	~~4-8~~ 5-0
	2-2x12	~~9-7~~ 10-3	~~8-4~~ 8-11	~~7-5~~ 8-0	~~6-9~~ 7-3	~~6-3~~ 6-9	~~5-10~~ 6-3	~~5-6~~ 5-11
	3-2x6	~~6-9~~ 7-0	~~5-10~~ 6-3	~~5-3~~ 5-7	~~4-9~~ 5-1	~~4-5~~ 4-9	~~4-2~~ 4-5	~~3-11~~ 4-2
	3-2x8	~~8-7~~ 9-3	~~7-5~~ 8-0	~~6-8~~ 7-2	~~6-1~~ 6-6	~~5-7~~ 6-0	~~5-3~~ 5-8	~~4-11~~ 5-4
	3-2x10	~~10-2~~ 10-11	~~8-10~~ 9-6	~~7-11~~ 8-6	~~7-2~~ 7-9	~~6-8~~ 7-2	~~6-3~~ 6-8	~~5-10~~ 6-4
	3-2x12	~~12-0~~ 12-11	~~10-5~~ 11-2	~~9-4~~ 10-0	~~8-6~~ 9-1	~~7-10~~ 8-5	~~7-41~~ 7-11	~~6-11~~ 7-5
Douglas fir-larch [g], Hem-fir [g], Spruce -pine-fir [g]	1-2x6	~~3-3~~ 3-5	~~2-5~~ 2-10	~~1-10~~ 2-5	~~1-6~~ 2-2	~~1-3~~ 2-0	~~1-1~~ 1-10	~~1-0~~ 1-9
	1-2x8	~~4-4~~ 4-7	~~3-2~~ 3-8	~~2-6~~ 3-2	~~2-0~~ 2-10	~~1-8~~ 2-7	~~1-6~~ 2-5	~~1-4~~ 2-4
	1-2x10	~~5-4~~ 5-8	~~4-1~~ 4-9	~~3-2~~ 4-1	~~2-7~~ 3-8	~~2-2~~ 3-4	~~1-11~~ 3-1	~~1-8~~ 2-11
	1-2x12	~~6-2~~ 6-7	~~5-0~~ 5-8	~~3-10~~ 5-0	~~3-2~~ 4-6	~~2-8~~ 4-1	~~2-4~~ 3-10	~~2-0~~ 3-7
	2-2x6	~~4-10~~ 5-2	~~4-2~~ 4-6	~~3-9~~ 4-0	~~3-1~~ 3-5	~~2-7~~ 3-1	~~2-3~~ 2-10	~~2-0~~ 2-7
	2-2x8	~~6-5~~ 6-11	~~5-7~~ 6-0	~~5-0~~ 5-3	~~4-1~~ 4-7	~~3-5~~ 4-1	~~3-0~~ 3-8	~~2-8~~ 3-5
	2-2x10	~~7-10~~ 8-5	~~6-10~~ 7-4	~~6-1~~ 6-6	~~5-39~~ 5-10	~~4-5~~ 5-2	~~3-10~~ 4-9	~~3-5~~ 4-5
	2-2x12	~~9-2~~ 9-10	~~7-11~~ 8-6	~~7-1~~ 7-7	~~6-4~~ 6-11	~~5-5~~ 6-4	~~4-8~~ 5-9	~~4-1~~ 5-4
	3-2x6	~~6-0~~ 6-6	~~5-31~~ 5-7	~~4-8~~ 5-0	~~4-3~~ 4-7	~~3-11~~ 4-2	~~3-5~~ 3-9	~~3-0~~ 3-5
	3-2x8	~~8-1~~ 8-8	~~7-0~~ 7-6	~~6-3~~ 6-8	~~5-8~~ 6-1	~~5-2~~ 5-6	~~4-6~~ 5-0	~~4-0~~ 4-7
	3-2x10	~~9-10~~ 10-7	~~8-6~~ 9-2	~~7-8~~ 8-2	~~7-0~~ 7-6	~~6-5~~ 6-11	~~5-9~~ 6-4	~~5-1~~ 5-10
	3-2x12	~~11-6~~ 12-4	~~9-11~~ 10-8	~~8-11~~ 9-7	~~8-1~~ 8-9	~~7-6~~ 8-1	~~7-0~~ 7-7	~~6-3~~ 7-1
Redwood [h], Western Cedars [h], Poderosa Pine [h], Red Pine [h]	1-2x6	~~3-4~~ 3-6	~~2-6~~ 2-11	~~1-11~~ 2-6	~~1-7~~ 2-3	~~1-4~~ 2-0	~~1-2~~ 1-11	~~1-0~~ 1-9
	1-2x8	~~4-2~~ 4-6	~~3-3~~ 3-10	~~2-7~~ 3-3	~~2-1~~ 2-11	~~1-9~~ 2-8	~~1-7~~ 2-6	~~1-4~~ 2-4
	1-2x10	~~5-1~~ 5-6	~~4-2~~ 4-9	~~3-3~~ 4-2	~~2-8~~ 3-9	~~2-3~~ 3-5	~~2-0~~ 3-2	~~1-9~~ 3-0
	1-2x12	~~5-11~~ 6-4	~~5-1~~ 5-6	~~4-0~~ 4-11	~~3-3~~ 4-6	~~2-9~~ 4-2	~~2-5~~ 3-11	~~2-1~~ 3-8
	2-2x6	~~4-11~~ 5-3	~~4-3~~ 4-7	~~3-10~~ 4-1	~~3-2~~ 3-6	~~2-8~~ 3-2	~~2-4~~ 2-11	~~2-1~~ 2-8
	2-2x8	~~6-3~~ 6-8	~~5-5~~ 5-9	~~4-10~~ 5-2	~~4-2~~ 4-8	~~3-7~~ 4-2	~~3-1~~ 3-10	~~2-9~~ 3-6
	2-2x10	~~7-7~~ 8-2	~~6-7~~ 7-1	~~5-10~~ 6-4	~~5-4~~ 5-9	~~4-7~~ 5-4	~~3-11~~ 4-10	~~3-6~~ 4-6
	2-2x12	~~8-10~~ 9-5	~~7-7~~ 8-2	~~6-10~~ 7-4	~~6-3~~ 6-8	~~5-6~~ 6-2	~~4-10~~ 5-9	~~4-3~~ 5-5
	3-2x6	~~6-2~~ 6-4	~~5-4~~ 5-8	~~4-9~~ 5-1	~~4-4~~ 4-8	~~4-0~~ 4-3	~~3-6~~ 3-10	~~3-1~~ 3-6
	3-2x8	~~7-9~~ 8-4	~~6-9~~ 7-3	~~6-0~~ 6-5	~~5-6~~ 5-11	~~5-1~~ 5-5	~~4-8~~ 5-1	~~4-1~~ 4-8
	3-2x10	~~9-6~~ 10-2	~~8-3~~ 8-10	~~7-4~~ 7-11	~~6-9~~ 7-2	~~6-3~~ 6-8	~~5-10~~ 6-3	~~5-3~~ 5-11
	3-2x12	~~11-0~~ 11-10	~~9-6~~ 10-3	~~8-6~~ 9-2	~~7-9~~ 8-4	~~7-3~~ 7-9	~~6-9~~ 7-3	~~6-4~~ 6-10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, L/Δ = 360 at main span, L/Δ = 180 at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5

TABLE R507.6
MAXIMUM DECK JOIST SPANS

LOAD [a] (psf)	JOIST SPECIES [b]	JOIST SIZE	ALLOWABLE JOIST SPAN [b,c] (feet-inches)			MAXIMUM CANTILEVER [f,g] (feet-inches)							
			Joist Spacing (inches)			~~Adacent~~ Joist Back Span [g] (feet)							
			12	16	24	4	6	8	10	12	14	16	18
40 Live Load	Southern Pine	2x6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP
		2x10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP
		2x12	18-0	16-6	13-6	1-0	1-6	2-0	2-6	3-0	3-6	4-0	4-1
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP	NP
		2x10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
		2x12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	3-11
	Redwood f, Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2x8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP
		2x12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
50 Ground Snow Load	Southern Pine	2x6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	12-1	11-0	~~9-7~~ 9-5	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
		2x10	15-5	~~14-1~~ 13-9	~~12-3~~ 11-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
		2x12	18-0	~~17-1~~ 16-2	~~14-6~~ 13-2	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	8-10	8-0	~~7-0~~ 6-8	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	11-7	10-7	~~9-3~~ 8-11	1-0	1-6	2-0	2-3	NP	NP	NP	NP
		2x10	14-10	~~13-6~~ 13-3	~~11-9~~ 10-10	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP
		2x12	~~18-0~~ 17-9	~~16-5~~ 15-5	13-912-7	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
	Redwood f, Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	8-3	7-6	~~6-8~~ 6-6	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2x8	10-10	9-10	~~8-7~~ 8-6	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	13-10	12-7	~~11-0~~ 10-5	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	16-10	~~15-3~~ 14-9	~~13-2~~ 12-1	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
60 Ground Snow Load	Southern Pine	2x6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	11-5	10-4	~~9-1~~ 8-9	1-0	1-6	2-0	2-4	NP	NP	NP	NP
		2x10	14-7	~~13-3~~ 12-9	~~11-7~~ 10-5	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
		2x12	~~17-8~~ 17-3	~~16-1~~ 15-0	~~14-0~~ 12-3	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	8-4	7-6	~~6-7~~ 6-2	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2x8	10-11	9-11	~~8-8~~ 8-3	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	13-11	~~12-8~~ 12-4	~~11-1~~ 10-0	1-0	1-6	2-0	2-6	2-10	NP	NP	NP
		2x12	~~17-0~~ 16-6	~~15-5~~ 14-3	~~13-6~~ 11-8	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Redwood f, Western Cedars [f], Ponderosa Pine [f],	2x6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP	NP
		2x8	10-2	9-3	~~8-1~~ 7-11	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2x10	13-0	~~11-10~~ 11-9	~~10-4~~ 9-7	1-0	1-6	2-0	2-6	2-7	NP	NP	NP

	Red Pine [f]	2x12	~~15-10~~ 15-9	~~14-4~~ 13-8	~~12-7~~ 11-2	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP
70 Ground Snow Load	Southern Pine	2x6	8-3	7-6	~~6-6~~ 6-5	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2x8	10-10	9-10	~~8-7~~ 8-2	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2x10	~~13-10~~ 13-9	~~12-7~~ 11-11	~~11-0~~ 9-9	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2x12	~~16-10~~ 16-2	~~15-3~~ 14-0	~~13-4~~ 11-5	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Douglas fir-larch [e], Hem-fir [e], Spruce-pine-fir [e]	2x6	7-11	~~7-2~~ 7-1	~~6-3~~ 5-9	1-0	1-6	NP	NP	NP	NP	NP	NP
		2x8	10-5	9-5	~~8-3~~ 7-8	1-0	1-6	2-0	2-1	NP	NP	NP	NP
		2x10	13-3	~~12-0~~ 11-6	~~10-6~~ 9-5	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
		2012	~~16-1~~ 15-5	~~14-8~~ 13-4	~~12-10~~ 10-11	1-0	1-6	2-0	2-6	3-0	3-3	~~3-3~~ NP	NP
	Redwood f, Western Cedars [f], Ponderosa Pine [f], Red Pine [f]	2x6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
		2x8	9-8	8-10	~~7-8~~ 7-4	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2x10	12-4	~~11-3~~ 11-0	~~9-10~~ 9-0	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
		2x12	~~15-0~~ 14-9	~~13-8~~ 12-9	~~11-11~~ 10-5	1-0	1-6	2-0	2-6	~~2-0~~ 3-0	3-0	NP	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg. NP = Not Permitted

a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.

b. No. 2 grade, wet service factor included.

c. L/Δ = 360 at main span.

d. L/Δ = 180 at cantilever with 220-pound point load applied to end.

e. Includes incising factor.

f. Incising factor not included.

g. Interpolation permitted. Extrapolation is not permitted.

TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST

LOAD [c] (psf)	JOIST SPAN [a] (feet)	On-CENTER SPACING OF FASTENERS [b] (inches)		
		$^1/_2$-inch diameter lag screw with $^1/_2$-inch maximum sheathing [d, e]	$^1/_2$-inch diameter bolt with $^1/_2$-inch maximum sheathing [e]	$^1/_2$-inch diameter bolt with 1-inch maximum sheathing [f]
40 Live Load	6	30	36	36
	8	23	36	36
	10	18	34	29
	12	15	29	24
	14	13	24	21
	16	11	21	18
	18	10	19	16
50 Ground Snow Load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 Ground Snow Load	6	25	36	36
	8	18	35	30
	10	~~17~~ 15	~~33~~ 28	~~28~~ 24
	12	~~14~~ 12	~~27~~ 23	~~23~~ 20
	14	~~12~~ 10	~~23~~ 20	~~20~~ 17
	16	~~11~~ 9	~~20~~ 17	~~17~~ 15
	18	~~9~~ 8	~~18~~ 15	~~15~~ 13
70 Ground Snow Load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation permitted. Extrapolation is not permitted.

b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.

c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.

d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.

e. Sheathing shall be wood structural panel or solid sawn lumber.

f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to $^1/_2$-inch thickness of stacked washers shall be permitted to substitute for up to $^1/_2$ inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

Commenter's Reason: RB184-19 was soley prepared to increase the functionality of Section R507. Its purpose is the expand the tables for those parts of the country where the snow loads exceed the 40psf floor live load. The DCC amended the tables to account for 50, 60 and 70 psf snow loads. The code action committee praised the DCC for its "inclusion of engineers in the effort was as a positive aspect for this proposal."
The DCC offered a floor modification at the CAH to amend some of the figures in the tables, but the committee did not accept them based on the volume of pages. They recommended that the DCC resubmit a public comment to correct the tables as necessary. The DCC has amended the figures, typos and a few format changes to correct these oversights.

While the public comment looks formidable, the scope of RB184-19 is very straight forward. The DCC recommends that you approve the proposal so a large part of the country, where snow loads exceed love floor loads, may be able to use Section R507.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
By adding additional loading values, designers will not need to hire an engineer to size the structural members.

Staff Analysis: There are four public comments to RB184, three which as for replacements of parts of the proposal, and on asking for as modified by the public comment. If all four are approved, there would be a conflict.

Public Comment# 1234

RB185-19

IRC: R312.1.4, 507.10 through 507.10.4(New)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), Retired from Chesterfield County, VA, representing Deck Code Coalition (csbajnai@gmail.com)

2018 International Residential Code

Revise as follows:

R312.1.4 Exterior ~~plastic composite~~ guards. ~~Plastic composite exterior~~ Exterior *guards* shall comply with the requirements of Section ~~R317.4.~~ R507.10.

Add new text as follows:

R507.10 Exterior guards. Guards shall be constructed to meet the requirements of Section R301.5, R312 and this section.

R507.10.1 Support of guards. Where guards are supported on deck framing, guard loads shall be transferred to the deck framing with a continuous load path to the deck joists.

R507.10.1.1 Guards supported by side of deck framing. Where guards are connected to the interior or exterior side of a deck joist or beam, the joist or beam shall be connected to the adjacent joists to prevent rotation of the joist or beam. Connections relying only on fasteners in end grain withdrawal are not permitted.

R507.10.1.2 Guards supported on top of deck framing. Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with approved manufacturer's instructions to transfer the guard loads to the adjacent joists.

R507.10.2 Wood guards. Wood posts supporting guard loads shall be a minimum 4x4. Such 4x4 wood posts supporting guard loads shall not be notched at the connection to the supporting structure.

R507.10.3 Plastic composite guards. Plastic composite guards shall comply with the provisions of Section R507.2.2.

R507.10.4 Other guards. Other approved guards shall be in accordance with manufacturer's instructions or in accordance with accepted engineering principles.

Reason: The Deck Code Coalition submits this code change to include direction for constructing exterior guards on decks where the code is currently silent. Guards provide the first line of defense against significant falls, which can result in serious and sometimes fatal injuries. Exterior guards on decks, particularly the connection of the guard system to the deck framing, are rarely engineered and even more rarely tested in a manner that proves that they are adequate to meet the requirements of Table R301.5. Exterior guards and the framing supporting them are susceptible to deterioration, and therefore require a level of care that we think should be addressed in the code.
While the language of the proposal does not define a prescriptive detail for either guard construction or a guard connection to deck framing, the intent of the language is to guide both the builder and the building officials toward an understanding of the behavior of the guard and the structure supporting the guard. The language provides guidance for developing details that will resist the action of a guard on the deck framing when the guard is protecting an occupant from falling to a lower level. This proposal should save lives.

Cost Impact: The code change proposal will increase the cost of construction
Current building practices may not meet the requirements of Table R301.5 when typical code-required safety factors are applied, it is reasonable to assume that there will be an increase in cost as the construction techniques and details of these elements are modified to meet the proposed language. A direct result will likely be an increase in the number of fasteners, blocking labor associated with the construction of exterior guards. For those currently construction code-compliant guards, there will be little, if any, additional costs.

For those that need to update their construction techniques and wish to do so using proprietary fasteners, the material cost increase may be approximately $20 per post, or approximately $140 for a 12 foot by 12 foot attached deck. The extra cost has to be weighed against the increased safety and potential life savings that will occur across the country over many years.

RB185-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

R507.10.1.2 Guards supported on top of deck framing. Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with ~~approved~~ manufacturer's instructions to transfer the guard loads to the adjacent joists.

R507.10.2 Wood posts at deck guards. ~~Wood posts supporting guard loads shall be a minimum 4x4. Such~~ 4x4 wood posts supporting guard loads applied to the top of the guard shall not be notched at the connection to the supporting structure.

R507.10.4 Other guards. Other ~~approved~~ guards shall be in accordance with manufacturer's instructions or in accordance with accepted engineering principles.

Committee Reason: The modification to Section R507.10.1.2 removed 'approved' because this adjective cannot be applied to manufacture's instructions. The modification to Section to R507.10.2 reworded the two sentences for clarity. The modification to Section R507.10.4 removes 'approved' because this would be confusing to the home owner. The proposal provided good general prescriptive language for guards that will reduce the need for engineering of guards. The committee had several suggestions for better wording that should come forward in a public comment: Add 'also' to Section R312.1.4; 'design' instead of 'construction' in Section 507.10; revise 'prevent' to 'limit' in Section R507.10.1.1; joists are part of the deck framing, so the language in Section R507.10.1 is confusing. (Vote: 9-2)

Assembly Action: **None**

RB185-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R312.1.4

Proponents:

Thomas Zuzik Jr, of Railingcodes.com; Representing NOMMA - The National Ornamental and Miscellanuous MEtals, representing NOMMA - The National Ornamental and Miscellanuous Metals Association (coderep@railingcodes.com); Charles Bajnai (csbajnai@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R312.1.4 Exterior Plastic Composite guards. Plastic composite exterior ~~Exterior~~ *guards* shall comply with the requirements of Section ~~R507.10~~ R317.4.

Commenter's Reason: Requesting through public comment to return section R312.1.4 back to the 2018 text.
The proponents of RB185-19 changed the language in R312.1.4 from "Exterior plastic composite guards" to "Exterior Guards", which is only a small part of the code change.

With changing the text from "exterior plastic composite guards" to all "exterior guards" for R312.1.4, this requires all exterior guards to go to the wood deck section in R507. Why are all exterior guards being sent to the wood deck section within the IRC?

Example: A new home with a masonry front porch and masonry stair flight, a side entrance porch and stair flight which is also masonry, a rear raised patio constructed of concrete dry laid blocks and concrete pavers and a second floor bi-parting exterior door that opens on to a metal fabricated balcony deck with a metal guard. All of the area's noted require guards because they exceed 30-inches in vertical height. However none of the required guard locations listed are wood nor a deck. So why is RB185-19 sending all exterior guards to the wood deck section?

Simply it shouldn't and by reverting back to the 2018 text just for R312.1.4 the rest of the proponents code change stays intact for RB185-19 and removes the conflict within the code that we believe was an unintended consequence of the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The effect of this public comment would be no change to the requirements for plastic composite guards. See the cost impact of the original proposal for other guards.

RB193-19

IRC®: TABLE R602.3(1) (New)

Proposed Change as Submitted

Proponents: Rick Allen, International Staple, Nail and Tool Association, representing International Staple, Nail and Tool Association (rallen@isanta.org)

2018 International Residential Code

Revise as follows:

TABLE R602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2 1/2″ × 0.113″) or 3-8d common (2 1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or3-3″ × 0.131″ nails; or 3- 3" 14 gage staples 7/16" crown	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131"); or 2- (3" x 0.131") nails or 2- 3" 14 gage staples 7/16" crown	Each end toe nail
		2-16d common (3½" x 0.162"); or 3-(3" x 0.131") nails or 3 -3" 14 gage staples 7/16" crown	End nail
	Flat blocking to truss and web filler	16d common (3½" x 0.162"); or (3" x 0.131") nails; or 3" 14 gage staples 7/16" crown	6" o.c. Face nail
2	Ceiling joists to top plate	Stainless Steel Fasteners Are Not Applicable In This Connection 4-8d box (2 1/2″ × 0.113″); or 3-8d common (2 1/2″ × 0.131″); or 3-10d box (3″ × 0.128″); or3-3″ × 0.131″ nails; or 3- 3" 14 gage staples 7/16" crown	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common (3 1/2″ × 0.162″); or 4-3″ × 0.131″ nails or 4- 3" 14 gage staples 7/16" crown	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1 1/4″ × 20	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″	Face nail each rafter

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
	ga. ridge strap to rafter	nails or 4- 3" 14 gage staples $^{7}/_{16}$" crown	
6	Rafter or roof truss to plate	Stainless Steel Fasteners Are Not Applicable In This Connection 3-16d box nails (3$^{1}/_{2}$″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d (3$^{1}/_{2}$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	Toe nail
		3-16d box 3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or3-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	End nail
		Wall	
8	Stud to stud (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	12″ o.c. face nail
		16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with $^{1}/_{2}$″ spacer)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3$^{1}/_{2}$″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2$^{1}/_{2}$″ × 0.113″); or 4-8d common (2$^{1}/_{2}$″ ×	Toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		0.131″); or 4-10d box (3″ × 0.128″)	
12	Top plate to top plate	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3" 14 gage staples $^{7}/_{16}$" crown	12″ o.c. face nail
13	Double top plate splice	8-16d common ($3^{1}/_{2}$″ × 0.162″); or 12-16d box ($3^{1}/_{2}$″ × 0.135″); or 12-10d box (3″ × 0.128″); or12-3″ × 0.131″ nails; or 12- 3" 14 gage staples $^{7}/_{16}$" crown	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common ($3^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		16d box ($3^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails; or 3" 14 gage staples $^{7}/_{16}$" crown	12″ o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	~~3 each 16″ o.c. face nail2 each 16″ o.c. face nail4 each 16″ o.c. face nail~~ 16″ o.c. face nail
16	Top or bottom plate to stud	4-8d box ($2^{1}/_{2}$″ × 0.113″); or 3-16d box ($3^{1}/_{2}$″ × 0.135″); or4-8d common ($2^{1}/_{2}$″ × 0.131″); or 4-10d box(3″ × 0.128″); or 4-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	Toe nail
		3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or3-3″ × 0.131″ nails; or 3- 3" 14 gage staples $^{7}/_{16}$" crown	End nail
17	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-3″ × 0.131″ nails; or 3- 3" 14 gage staples $^{7}/_{16}$" crown	Face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
18	1″ brace to each stud and plate	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box ($2^1/_2$″ × 0.113″); or 2-8d common ($2^1/_2$″ × 0.131″); or 2-(3" x 0.131"); or 2-10d box (3″ × 0.128″); or ~~2 staples $1^3/_4$″~~ 2- 3" 14 gage staples $^7/_{16}$" crown	Face nail
19	1″ × 6″ sheathing to each bearing	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box ($2^1/_2$″ × 0.113″); or 2-8d common ($2^1/_2$″ × 0.131″); or 2-10d box (3″ × 0.128″); or2 staples, 1″ crown, 16 ga., $1^3/_4$″ long	Face nail
20	1″ × 8″ and wider sheathing to each bearing	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box ($2^1/_2$″ × 0.113″); or3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or3 staples, 1″ crown, 16 ga., $1^3/_4$″long	Face nail
		Stainless Steel Fasteners Are Not Applicable In This Connection Wider than 1″ × 8″4-8d box ($2^1/_2$″ × 0.113″); or3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., $1^3/_4$″ long	
Floor			
21	Joist to sill, top plate or girder	4-8d box ($2^1/_2$″ × 0.113″); or3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or3-3″ × 0.131″ nails; or 3- 3" 14 gage staples $^7/_{16}$" crown	Toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box ($2^{1}/_{2}$″ × 0.113″)	4″ o.c. toe nail
		8d common ($2^{1}/_{2}$″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails; or 3" 14 gage staples $^{7}/_{16}$" crown	6″ o.c. toe nail
23	1″ × 6″ subfloor or less to each joist	Stainless Steel Fasteners Are Not Applicable In This Connection 3-8d box ($2^{1}/_{2}$″ × 0.113″); or 2-8d common ($2^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or2 staples, 1″ crown, 16 ga., $1^{3}/_{4}$″ long	Face nail
		Floor	
24	2″ subfloor to joist or girder	3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″)	Blind and face nail
25	2″ planks (plank & beam—floor & roof)	3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″)	At each bearing, face nail
26	Band or rim joist to joist	3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-10 box (3″ × 0.128″), or 4-3″ × 0.131″ nails; or 4-3″ × 14 ga. staples, $^{7}/_{16}$″ crown	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.
		10d box (3″ × 0.128″); or3″ × 0.131″ nails; or 3" 14 gage staples $^{7}/_{16}$" crown	24″ o.c. face nail at top and bottom staggered on opposite sides
		And:2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails; or 4- 3" 14 gage staples $^{7}/_{16}$" crown	Face nail at ends and at each splice
28	Ledger strip supporting joists or rafters	4-16d box ($3^{1}/_{2}$″ × 0.135″); or 3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-10d box (3″ × 0.128″); or4-3″ × 0.131″ nails; or 3- 3" 14 gage staples $^{7}/_{16}$" crown	At each joist or rafter, face nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″), or 2-8d common (2 1/2″ × 0.131″; or 2-3″ × 0.131″) nails; or 2-3" 14 gage staples 7/16" crown	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS	
			Edges (inches)[h]	Intermediate supports[c, e] (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel *exterior wall sheathing to wall framing]*				
30	3/8″ – 1/2″	6d common or deformed (2″ × 0.113″); or 2 3/8″ × 0.113″ nail (subfloor, wall)[i] ~~8d common (2 1/2″ × 0.131″) nail (roof); or RSRS-01 (2 3/8″ × 0.113″) nail (roof)[j]~~	6	12
		8d common (2 1/2″ × 0.131″) nail (roof); or RSRS-01 (2 3/8″ × 0.113″) nail (roof)[j]	6	12[f]
		2 3/8″ × 0.113″ (roof)	4	8
31	19/32″ – ~~1″~~ 3/4"	8d common nail (2 1/2″ × 0.131″); or RSRS-01; (2 3/8″ × 0.113″) nail (roof)[j]	6	12[f]
		2 3/8″ × 0.113″ (roof)	4	8
		deformed 2" x 0.113" (wall or subfloor)	6	12
32	~~1 1/8″~~ 7/8" – 1 1/4″	10d common (3″ × 0.148″) nail; or ~~8d~~ (2 1/2″ × 0.131″) deformed nail	6	12
Other wall sheathing[g]				
33	1/2″ structural cellulosic fiberboard sheathing	1 1/2″ x 0.120" galvanized roofing nail, 7/16″ head diameter, or 1 1/4″ long 16 ga. staple with 7/16″ or 1″ crown	3	6
34	25/32″ structural cellulosic fiberboard sheathing	1 3/4″ x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 1/2″ long 16	3	6

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION	
		ga. staple with 7/16" or 1" crown		
35	1/2" gypsum sheathing[d]	1 1/2" x 0.120 galvanized roofing nail, 7/16" head diameter; or 16 gage staple galvanized, 1 1/2" long; 7/16" or 1" crown or 1 1/4" screws, Type W or S	7	7
36	5/8" gypsum sheathing[d]	1 3/4" x 0.120" galvanized roofing nail; 7/16" head diameter; or 16 gage staple galvanized, 1 5/8" long; 7/16" or 1" crown; or 1 5/8" screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	3/4" and less	deformed (2" x 0.113") or ~~6d~~ deformed (2" × 0.120") nail; or 8d common (2 1/2" × 0.131") nail	6	12
38	7/8" – 1"	8d common (2 1/2" × 0.131") nail; or deformed (2½" x 0.131"); or ~~8d~~ deformed (2 1/2" × 0.120") nail	6	12
39	1 1/8" – 1 1/4"	10d common (3" × 0.148") nail; or deformed (2½" x 0.131"); or ~~8d~~ deformed (2 1/2" × 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.

~~b. Staples are 16 gage wire and have a minimum 7/16-inch on diameter crown width.~~

c .Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.
g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.
h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.
j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Reason: IRC Table R602.3(1) and IBC Table 2304.10.1 are essentially the same table in terms or structural connections. Although the connections are closely aligned, there are variations in the prescribed fastener in the two tables. Some fasteners are prescribed in the IRC table and not in the IBC table and others are prescribed in the IBC table and not the IRC table. This proposal is written to harmonize the fasteners between the two tables. In addition, where additional information exists in one table and not the other, this too is being harmonized.
For connection # 2,6,18,19, 20 & 23 there was a code change proposal RB272-13 entered in by the American Wood Council for the 2015 IRC. The reference nail values for the nailing schedule were based on Reference Lateral Values and Reference Withdrawal values. All other connections in the table were based on Reference Lateral Design Values. In the 2018 NDS, the reference withdrawal values for stainless steel nails were tabulated in a new NDS table (12.2D). The withdrawal values for stainless steel are lower than the values for carbon steel (bright or galvanized) nails of equivalent diameters.

As such, the lower stainless steel withdrawal values combined with the publication date of the 2018 NDS and the 2015 code proposal date would indicate that the basis of the original code proposal is relevant to only carbon steel nails and not to stainless steel nails. The added note to these connections is to exclude stainless steel from these connections based on the lower withdrawal values.

Connection 1:

Added 14 gage staple from IBC 2304.10.1

Added Blocking Between Rafters or Truss not at the wall top plate to rafter or truss from IBC 2304.10.1

Added flat blocking to truss and web filler from IBC 2304.10.1

Connection 2:

Added note regarding stainless steel fasteners

Added 14 gage staples from IBC 2304.10.1

Connection 3, 5

Added 14 gage staples from IBC 2304.10.1

Connection 6

Added note regarding stainless steel fasteners

Added 14 gage staples from IBC 2304.10.1

Connections 7, 8, 9, 12, 13, 14, 15, 16, 17

Added 14 gage staples from IBC 2304.10.1

Connection 15

Changed fastener spacing and location description to match IBC 2304.10.1

Connection 18

Added note regarding stainless steel fasteners

Added 3" x 0.131" nails from IBC 2304.10.1

Added 14 gage staples from IBC 2304.10.1 and eliminated the 16 gage staple reference

Connections 19 & 20

Added note regarding stainless steel fasteners

Connection 21 & 22

Added 14 gage staples from IBC 2304.10.1

Connection 23

Added note regarding stainless steel fasteners

Connections 27, 28 & 29

Added 14 gage staples from IBC 2304.10.1

Connection 30:

The roof fasteners have been separated from the subfloor and wall fasteners for better clarification when reading

Connection 31:

Panel thickness range is changed to match the thickness range in the IBC.

Connection 32:

Panel thickness range is changed to match the thickness range in the IBC. Additionally, the description **8d** deformed (2½" x 0.131") in an incorrect description. ASTM F1667 does not have a classification for 8d deformed. The correct description is a deformed 2½" x 0.131" nail.

Connections 33 -34

The current nail descriptions are incomplete and missing a shank diameter. These changes match SDPWS

Connection 35-36

The current nail descriptions are incomplete and missing a shank diameter.

Connection 37:

Adding the deformed 2" x 0.113" nail will harmonize with the IBC table. A **6d** deformed 2" x 0.120" nail is not addressed in ASTM F1667. The correct description is a deformed 2" x 0.120" nail and should be used to avoid confusion

Connection 38 & 39:

An **8d** deformed 2½" x 0.120 nail is not addressed in ASTM F1667. The correct description is a deformed 2½" x 0.120 nail and should be used to avoid confusion

Footnote b. deleted because of the addition of the 14 gage staples to the table

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed changes should not change cost of construction as it harmonizes the fasteners between the IBC and IRC

RB193-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:
TABLE R602.3(1)

FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
Roof			

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2$^1/_2$″ × 0.113″) or 3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^7/_{16}$" crown~~	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131"); or 2- (3" x 0.131") nails ~~or 2- 3" 14 gage staples $^7/_{16}$" crown~~	Each end toe nail
		2-16d common (3½" x 0.162"); or 3-(3" x 0.131") nails ~~or 3- 3" 14 gage staples $^7/_{16}$" crown~~	End nail
	Flat blocking to truss and web filler	16d common (3½" x 0.162"); or (3" x 0.131") nails; ~~or 3" 14 gage staples $^7/_{16}$" crown~~	6" o.c. Face nail
2	Ceiling joists to top plate	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 4-8d box (2$^1/_2$″ × 0.113″); or 3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^7/_{16}$" crown~~	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common (3$^1/_2$″ × 0.162″); or 4-3″ × 0.131″ nails~~ or 4- 3" 14 gage staples $^7/_{16}$" crown~~	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1$^1/_4$″ × 20 ga. ridge strap to rafter	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails ~~or 4- 3" 14 gage staples $^7/_{16}$" crown~~	Face nail each rafter
6	Rafter or roof truss to plate	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 3-16d box nails (3$^1/_2$″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^7/_{16}$" crown~~	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d (3$^1/_2$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^7/_{16}$" crown~~	Toe nail
		3-16d box 3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^7/_{16}$" crown~~	End nail
		Wall	
8	Stud to stud (not at braced wall panels)	16d common (3$^1/_2$″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^7/_{16}$" crown~~	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3$^1/_2$″ × 0.135″); or 3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^7/_{16}$" crown~~	12″ o.c. face nail
		16d common (3$^1/_2$″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with $^1/_2$″ spacer)	16d common (3$^1/_2$″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3$^1/_2$″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2$^1/_2$″ × 0.113″); or 4-8d common (2$^1/_2$″ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail
12	Top plate to top plate	16d common (3$^1/_2$″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails~~; or 3" 14 gage staples $^7/_{16}$" crown~~	12″ o.c. face nail
13	Double top plate splice	8-16d common (3$^1/_2$″ × 0.162″); or 12-16d box (3$^1/_2$″ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails~~; or 12- 3" 14 gage staples $^7/_{16}$" crown~~	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails~~; or 3" 14 gage staples $^{7}/_{16}$" crown~~	12″ o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^{7}/_{16}$" crown~~	3 each 16″ o.c. face nail2 each 16″ o.c. face nail4 each 16″ o.c. face nail 16″ o.c. face nail
16	Top or bottom plate to stud	4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-16d box (3$^{1}/_{2}$″ × 0.135″); or4-8d common (2$^{1}/_{2}$″ × 0.131″); or 4-10d box(3″ × 0.128″); or 4-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^{7}/_{16}$" crown~~	Toe nail
		3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^{7}/_{16}$" crown~~	End nail
17	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 3-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^{7}/_{16}$" crown~~	Face nail
18	1″ brace to each stud and plate	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 3-8d box (2$^{1}/_{2}$″ × 0.113″); or 2-8d common (2$^{1}/_{2}$″ × 0.131″); or 2-(3" x 0.131"); or 2-10d box (3″ × 0.128″)~~; or 2 staples 1$^{3}/_{4}$″ 2- 3" 14 gage staples $^{7}/_{16}$" crown~~	Face nail
19	1″ × 6″ sheathing to each bearing	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 3-8d box (2$^{1}/_{2}$″ × 0.113″); or 2-8d common (2$^{1}/_{2}$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	Face nail
20	1″ × 8″ and wider sheathing to each bearing	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 3-8d box (2$^{1}/_{2}$″ × 0.113″); or3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″long	Face nail
		~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ Wider than 1″ × 8″4-8d box (2$^{1}/_{2}$″ × 0.113″); or3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	
Floor			
21	Joist to sill, top plate or girder	4-8d box (2$^{1}/_{2}$″ × 0.113″); o r3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^{7}/_{16}$" crown~~	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2$^{1}/_{2}$″ × 0.113″)	4″ o.c. toe nail
		8d common (2$^{1}/_{2}$″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails~~; or 3" 14 gage staples $^{7}/_{16}$" crown~~	6″ o.c. toe nail
23	1″ × 6″ subfloor or less to each joist	~~Stainless Steel Fasteners Are Not Applicable In This Connection~~ 3-8d box (2$^{1}/_{2}$″ × 0.113″); or 2-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1$^{3}/_{4}$″ long	Face nail
Floor			
24	2″ subfloor to joist or girder	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″)	Blind and face nail
25	2″ planks (plank & beam—floor & roof)	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″)	At each bearing, face nail
26	Band or rim joist to joist	3-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-10 box (3″ × 0.128″), or 4-3″ × 0.131″ nails~~; or 4-3″ × 14 ga. staples, $^{7}/_{16}$″ crown~~	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
		10d box (3″ × 0.128″); or3″ × 0.131″ nails~~; or 3" 14 gage staples $^{7}/_{16}$" crown~~	24″ o.c. face nail at top and bottom staggered on opposite sides
		And:2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails~~; or 4- 3" 14 gage staples $^{7}/_{16}$" crown~~	Face nail at ends and at each splice
28	Ledger strip supporting joists or rafters	4-16d box (3$^{1}/_{2}$″ × 0.135″); or 3-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails~~; or 3- 3" 14 gage staples $^{7}/_{16}$" crown~~	At each joist or rafter, face nail
29	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″), or 2-8d common (2$^{1}/_{2}$″ × 0.131″; or 2-3″ × 0.131″) nails~~; or 2-3" 14 gage staples $^{7}/_{16}$" crown~~	Each end, toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS	
			Edges (inches)[h]	Intermediate supports[c, e](inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel *exterior wall sheathing to wall framing]*				
30	$^{3}/_{8}$″ – $^{1}/_{2}$″	6d common or deformed (2″ × 0.113″ x 0.266" head); or 2$^{3}/_{8}$″ × 0.113″ x 0.266" head nail (subfloor, wall)[i]8d common (2$^{1}/_{2}$″ × 0.131″) nail (roof); or RSRS-01 (2$^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12
		8d common (2$^{1}/_{2}$″ × 0.131″) nail (roof); or RSRS-01 (2$^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12[f]
		~~2$^{3}/_{8}$″ × 0.113″ (roof)~~	~~4~~	~~8~~
31	$^{19}/_{32}$″ – 1″ $^{3}/_{4}$"	8d common nail (2$^{1}/_{2}$″ × 0.131″); or RSRS-01; (2$^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12[f]
		~~2$^{3}/_{8}$″ × 0.113″ (roof)~~	~~4~~	~~8~~
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	1$^{1}/_{8}$″ $^{7}/_{8}$" – 1$^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or 8d (2$^{1}/_{2}$″ × 0.131″ x 0.281" head) deformed nail	6	12
Other wall sheathing[g]				
33	$^{1}/_{2}$″ structural cellulosic fiberboard sheathing	1$^{1}/_{2}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$″ head diameter, or 1$^{1}/_{4}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
34	$^{25}/_{32}$″ structural cellulosic fiberboard sheathing	1$^{3}/_{4}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$" head diameter, or 1$^{1}/_{2}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
35	$^{1}/_{2}$″ gypsum sheathing[d]	1$^{1}/_{2}$″ x 0.120 galvanized roofing nail, $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,1$^{1}/_{2}$″ long;$^{7}/_{16}$″ or 1″ crown or 1$^{1}/_{4}$″ screws, Type W or S	7	7
36	$^{5}/_{8}$″ gypsum sheathing[d]	1$^{3}/_{4}$″ x 0.120" galvanized roofing nail; $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,1$^{5}/_{8}$″ long;$^{7}/_{16}$″ or 1″ crown; or 1$^{5}/_{8}$″ screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$^{3}/_{4}$″ and less	deformed (2" x 0.113") or 6d deformed (2″ × 0.120″) nail; or 8d common (2$^{1}/_{2}$″ × 0.131″) nail	6	12
38	$^{7}/_{8}$″ – 1″	8d common (2$^{1}/_{2}$″ × 0.131″) nail; or deformed (2½" x 0.131"); or 8d deformed (2$^{1}/_{2}$″ × 0.120″) nail	6	12
39	1$^{1}/_{8}$″ – 1$^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or deformed (2½" x 0.131"); or 8d deformed (2$^{1}/_{2}$″ × 0.120″) nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less.

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Committee Reason: The modification removes staples since they are not equivalent. Also the prohibition of stainless steel nails was removed - this is needed in coastal areas where there is exposure to salt spray. Stainless steel fasteners can be evaluated as equivalent. The main change will coordinate the IRC and IBC tables. The proposal with the modification will allow for different construction options. (Vote: 9-2)

Assembly Action: **None**

RB193-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R602.3(1) (New)

Proponents:
Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

TABLE R602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2$^{1}/_{2}$″ × 0.113″) or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131"); or 2- (3" x 0.131") nails	Each end toe nail
		2-16d common (3½" x 0.162"); or 3-(3" x 0.131") nails	End nail
	Flat blocking to truss and web filler	16d common (3½" x 0.162"); or (3" x 0.131") nails;	6" o.c. Face nail
2	Ceiling joists to top plate	4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1$^{1}/_{4}$″ × 20 ga. ridge strap to rafter	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate	S 3-16d box nails (3$^{1}/_{2}$″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d (3$^{1}/_{2}$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box 3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
		Wall	
8	Stud to stud (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with $^{1}/_{2}$″ spacer)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3$^{1}/_{2}$″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2$^{1}/_{2}$″ × 0.113″); or 4-8d common (2$^{1}/_{2}$″ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail
12	Top plate to top plate	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	12″ o.c. face nail
13	Double top plate splice	8-16d common (3$^{1}/_{2}$″ × 0.162″); or 12-16d box (3$^{1}/_{2}$″ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails	3 each 16″ o.c. face nail2 each 16″ o.c. face nail4 each 16″ o.c. face nail 16″ o.c. face nail
		4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-16d box (3$^{1}/_{2}$″ × 0.135″); or4-8d common (2$^{1}/_{2}$″ × 0.131″); or 4-10d box(3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail

16	Top or bottom plate to stud	0.131″ nails	
		3-16d box (3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
17	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common (3$^1/_2$″ × 0.162″); or 3-3″ × 0.131″ nails	Face nail
18	1″ brace to each stud and plate	3-8d box (2$^1/_2$″ × 0.113″); or 2-8d common (2$^1/_2$″ × 0.131″); or 2-(3" x 0.131"); or 2-10d box (3″ × 0.128″)	Face nail
19	1″ × 6″ sheathing to each bearing	3-8d box (2$^1/_2$″ × 0.113″); or 2-8d common (2$^1/_2$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1$^3/_4$″ long	Face nail
20	1″ × 8″ and wider sheathing to each bearing	3-8d box (2$^1/_2$″ × 0.113″); or3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., 1$^3/_4$″long	Face nail
		Wider than 1″ × 8″4-8d box (2$^1/_2$″ × 0.113″); or3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., 1$^3/_4$″ long	
Floor			
21	Joist to sill, top plate or girder	4-8d box (2$^1/_2$″ × 0.113″); o r3-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails;	Toe nail
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2$^1/_2$″ × 0.113″)	4″ o.c. toe nail
		8d common (2$^1/_2$″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails	6″ o.c. toe nail
23	1″ × 6″ subfloor or less to each joist	3-8d box (2$^1/_2$″ × 0.113″); or 2-8d common (2$^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., 1$^3/_4$″ long	Face nail
Floor			
24	2″ subfloor to joist or girder	3-16d box (3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″)	Blind and face nail
25	2″ planks (plank & beam—floor & roof)	3-16d box (3$^1/_2$″ × 0.135″); or 2-16d common (3$^1/_2$″ × 0.162″)	At each bearing, face nail
26	Band or rim joist to joist	3-16d common (3$^1/_2$″ × 0.162″); or 4-10 box (3″ × 0.128″), or 4-3″ × 0.131″ nails	End nail
27	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.
		10d box (3″ × 0.128″); or3″ × 0.131″ nails	24″ o.c. face nail at top and bottom staggered on opposite sides
		And:2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Face nail at ends and at each splice
28	Ledger strip supporting joists or rafters	4-16d box (3$^1/_2$″ × 0.135″); or 3-16d common (3$^1/_2$″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	At each joist or rafter, face nail
29	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″), or 2-8d common (2$^1/_2$″ × 0.131″; or 2-3″ × 0.131″) nails	Each end, toe nail

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING OF FASTENERS	
			Edges (inches)[h]	Intermediate supports[c, e](inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel *exterior wall sheathing to wall framing]*				
30	$^3/_8$″ – $^1/_2$″	6d common or deformed (2″ × 0.113″ x 0.266" head); or 2$^3/_8$″ × 0.113″ x 0.266" head nail (subfloor, wall)[i]8d common (2$^1/_2$″ × 0.131″) nail (roof); or RSRS-01 (2$^3/_8$″ × 0.113″) nail (roof)[j]	6	12
		8d common (2$^1/_2$″ × 0.131″) nail (roof); or RSRS-01 (2$^3/_8$″ × 0.113″) nail (roof)[j]	6	12[f]

31	$^{19}/_{32}$″ – 1″ $^{3}/_{4}$"	8d common nail ($2^{1}/_{2}$″ × 0.131″); or RSRS-01; ($2^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12[f]
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	$1^{1}/_{8}$″ $^{7}/_{8}$" – $1^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or 8d ($2^{1}/_{2}$″ × 0.131″ x 0.281" head) deformed nail	6	12
Other wall sheathing[g]				
33	$^{1}/_{2}$″ structural cellulosic fiberboard sheathing	$1^{1}/_{2}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$″ head diameter, or $1^{1}/_{4}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
34	$^{25}/_{32}$″ structural cellulosic fiberboard sheathing	$1^{3}/_{4}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$" head diameter, or $1^{1}/_{2}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
35	$^{1}/_{2}$″ gypsum sheathing[d]	$1^{1}/_{2}$″ x 0.120 galvanized roofing nail, $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,$1^{1}/_{2}$″ long;$^{7}/_{16}$″ or 1″ crown or $1^{1}/_{4}$″ screws, Type W or S	7	7
36	$^{5}/_{8}$″ gypsum sheathing[d]	$1^{3}/_{4}$″ x 0.120" galvanized roofing nail; $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,$1^{5}/_{8}$″ long;$^{7}/_{16}$″ or 1″ crown; or $1^{5}/_{8}$″ screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$^{3}/_{4}$″ and less	deformed (2" x 0.113") or 6d deformed (2″ × 0.120″) nail; or 8d common ($2^{1}/_{2}$″ × 0.131″) nail	6	12
38	$^{7}/_{8}$″ – 1″	8d common ($2^{1}/_{2}$″ × 0.131″) nail; or deformed (2½" x 0.131"); or 8d deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12
39	$1^{1}/_{8}$″ – $1^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or deformed (2½" x 0.131"); or 8d deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials or dimensions, such as stainless steel, shall be designed by accepted engineering practice or approved under Section R104.11.

b. Staples are 16 gage wire and have a minimum

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Commenter's Reason: This public comment adds language to new footnote a in order to further clarify that the code change proposal, as approved at the CAH, deletes stainless steel nails and staples from this table. The added language is proposed because it is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel is not carbon steel.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Since stainless steel is being deleted in the approval in the CAH, this comment only provides clarification and does not add any cost effects to what is already accepted.

Public Comment# 1947

Public Comment 2:

IRC®: TABLE R602.3(1) (New)

Proponents:

J Daniel Dolan, representing Federal Emergency Management Agency/ Applied Technology Council Seismic Codes Support Committee (jddolan@wsu.edu)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

TABLE R602.3(1)
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists or rafters or trusses to top plate or other framing below	4-8d box (2$^{1}/_{2}$″ × 0.113″) or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
	Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131"); or 2- (3" x 0.131") nails	Each end toe nail
		2-16d common (3½" x 0.162"); or 3-(3" x 0.131") nails	End nail
	Flat blocking to truss and web filler	16d common (3½" x 0.162"); or (3" x 0.131") nails;	6" o.c. Face nail
2	Ceiling joists to top plate	4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-8d common (2$^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section R802.5.2 and Table R802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section R802.5.2 and Table R802.5.2)	Table R802.5.2	Face nail
5	Collar tie to rafter, face nail or 1$^{1}/_{4}$″ × 20 ga. ridge strap to rafter	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate	S 3-16d box nails (3$^{1}/_{2}$″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d (3$^{1}/_{2}$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box 3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail
		Wall	
8	Stud to stud (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	24″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	16″ o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
		16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
10	Built-up header (2″ to 2″ header with $^{1}/_{2}$″ spacer)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. each edge face nail
		16d box (3$^{1}/_{2}$″ × 0.135″)	12″ o.c. each edge face nail
11	Continuous header to stud	5-8d box (2$^{1}/_{2}$″ × 0.113″); or 4-8d common (2$^{1}/_{2}$″ × 0.131″); or 4-10d box (3″ × 0.128″)	Toe nail
12	Top plate to top plate	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		10d box (3″ × 0.128″); or 3″ × 0.131″ nails	12″ o.c. face nail
13	Double top plate splice	8-16d common (3$^{1}/_{2}$″ × 0.162″); or 12-16d box (3$^{1}/_{2}$″ × 0.135″); or 12-10d box (3″ × 0.128″); or 12-3″ × 0.131″ nails	Face nail on each side of end joint (minimum 24″ lap splice length each side of end joint)
14	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3$^{1}/_{2}$″ × 0.162″)	16″ o.c. face nail
		16d box (3$^{1}/_{2}$″ × 0.135″); or 3″ × 0.131″ nails	12″ o.c. face nail
15	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3$^{1}/_{2}$″ × 0.135″); or 2-16d common (3$^{1}/_{2}$″ × 0.162″); or 4-3″ × 0.131″ nails	3 each 16″ o.c. face nail2 each 16″ o.c. face nail4 each 16″ o.c. face nail 16″ o.c. face nail
		4-8d box (2$^{1}/_{2}$″ × 0.113″); or 3-16d box (3$^{1}/_{2}$″ × 0.135″); or4-8d common (2$^{1}/_{2}$″ × 0.131″); or 4-10d box(3″ × 0.128″); or 4-3″ ×	Toe nail

16	Top or bottom plate to stud	0.131″ nails		
		3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail	
17	Top plates, laps at corners and intersections	3-10d box (3″ × 0.128″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″); or 3-3″ × 0.131″ nails	Face nail	
18	1″ brace to each stud and plate	3-8d box ($2^{1}/_{2}$″ × 0.113″); or 2-8d common ($2^{1}/_{2}$″ × 0.131″); or 2-(3" x 0.131"); or 2-10d box (3″ × 0.128″)	Face nail	
19	1″ × 6″ sheathing to each bearing	3-8d box ($2^{1}/_{2}$″ × 0.113″); or 2-8d common ($2^{1}/_{2}$″ × 0.131″); or 2-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., $1^{3}/_{4}$″ long	Face nail	
20	1″ × 8″ and wider sheathing to each bearing	3-8d box ($2^{1}/_{2}$″ × 0.113″); or3-8d common ($2^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3 staples, 1″ crown, 16 ga., $1^{3}/_{4}$″long	Face nail	
		Wider than 1″ × 8″4-8d box ($2^{1}/_{2}$″ × 0.113″); or3-8d common ($2^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 4 staples, 1″ crown, 16 ga., $1^{3}/_{4}$″ long		
Floor				
21	Joist to sill, top plate or girder	4-8d box ($2^{1}/_{2}$″ × 0.113″); o r3-8d common ($2^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails;	Toe nail	
22	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box ($2^{1}/_{2}$″ × 0.113″)	4″ o.c. toe nail	
		8d common ($2^{1}/_{2}$″ × 0.131″); or 10d box (3″ × 0.128″); or 3″ × 0.131″ nails	6″ o.c. toe nail	
23	1″ × 6″ subfloor or less to each joist	3-8d box ($2^{1}/_{2}$″ × 0.113″); or 2-8d common ($2^{1}/_{2}$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 2 staples, 1″ crown, 16 ga., $1^{3}/_{4}$″ long	Face nail	
Floor				
24	2″ subfloor to joist or girder	3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″)	Blind and face nail	
25	2″ planks (plank & beam—floor & roof)	3-16d box ($3^{1}/_{2}$″ × 0.135″); or 2-16d common ($3^{1}/_{2}$″ × 0.162″)	At each bearing, face nail	
26	Band or rim joist to joist	3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-10 box (3″ × 0.128″), or 4-3″ × 0.131″ nails	End nail	
27	Built-up girders and beams, 2-inch lumber layers	20d common (4″ × 0.192″); or	Nail each layer as follows: 32″ o.c. at top and bottom and staggered.	
		10d box (3″ × 0.128″); or3″ × 0.131″ nails	24″ o.c. face nail at top and bottom staggered on opposite sides	
		And:2-20d common (4″ × 0.192″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Face nail at ends and at each splice	
28	Ledger strip supporting joists or rafters	4-16d box ($3^{1}/_{2}$″ × 0.135″); or 3-16d common ($3^{1}/_{2}$″ × 0.162″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	At each joist or rafter, face nail	
29	Bridging or blocking to joist, rafter or truss	2-10d box (3″ × 0.128″), or 2-8d common ($2^{1}/_{2}$″ × 0.131″; or 2-3″ × 0.131″) nails	Each end, toe nail	
ITEM	**DESCRIPTION OF BUILDING ELEMENTS**	**NUMBER AND TYPE OF FASTENER**[a, b, c]	**SPACING OF FASTENERS**	
			Edges (inches)[h]	**Intermediate supports**[c, e]**(inches)**
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel *exterior wall sheathing to wall framing]*				
30	$^{3}/_{8}$″ – $^{1}/_{2}$″	6d common or deformed (2″ × 0.113″ x 0.266" head); or $2^{3}/_{8}$″ × 0.113″ x 0.266" head nail (subfloor, wall)[i]8d common ($2^{1}/_{2}$″ × 0.131″) nail (roof); or RSRS-01 ($2^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12
		8d common ($2^{1}/_{2}$″ × 0.131″) nail (roof); or RSRS-01 ($2^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12[f]

31	$^{19}/_{32}$″ – 1″ $^{3}/_{4}$"	8d common nail ($2^{1}/_{2}$″ × 0.131″); or RSRS-01; ($2^{3}/_{8}$″ × 0.113″) nail (roof)[j]	6	12[f]
		deformed 2" x 0.113" x 0.266" head (wall or subfloor)	6	12
32	$1^{1}/_{8}$″ $^{7}/_{8}$" – $1^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or 8d ($2^{1}/_{2}$″ × 0.131″ x 0.281" head) deformed nail	6	12
Other wall sheathing[g]				
33	$^{1}/_{2}$″ structural cellulosic fiberboard sheathing	$1^{1}/_{2}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$″ head diameter, or $1^{1}/_{4}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
34	$^{25}/_{32}$″ structural cellulosic fiberboard sheathing	$1^{3}/_{4}$″ x 0.120" galvanized roofing nail, $^{7}/_{16}$" head diameter, or $1^{1}/_{2}$″ long 16 ga. staple with $^{7}/_{16}$″ or 1″ crown	3	6
35	$^{1}/_{2}$″ gypsum sheathing[d]	$1^{1}/_{2}$″ x 0.120 galvanized roofing nail, $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,$1^{1}/_{2}$″ long;$^{7}/_{16}$″ or 1″ crown or $1^{1}/_{4}$″ screws, Type W or S	7	7
36	$^{5}/_{8}$″ gypsum sheathing[d]	$1^{3}/_{4}$″ x 0.120" galvanized roofing nail; $^{7}/_{16}$" head diameter; or 16 gage staple galvanized,$1^{5}/_{8}$″ long;$^{7}/_{16}$″ or 1″ crown; or $1^{5}/_{8}$″ screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
37	$^{3}/_{4}$″ and less	deformed (2" x 0.113") or 6d deformed (2″ × 0.120″) nail; or 8d common ($2^{1}/_{2}$″ × 0.131″) nail	6	12
38	$^{7}/_{8}$″ – 1″	8d common ($2^{1}/_{2}$″ × 0.131″) nail; or deformed (2½" x 0.131"); or 8d deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12
39	$1^{1}/_{8}$″ – $1^{1}/_{4}$″	10d common (3″ × 0.148″) nail; or deformed (2½" x 0.131"); or 8d deformed ($2^{1}/_{2}$″ × 0.120″) nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials, such as stainless steel, shall be designed by accepted engineering practice or approved under Section R104.11.

b. Staples are 16 gage wire and have a minimum

c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.

e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).

f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 6 inches on center where the ultimate design wind speed is less than 130 mph and shall be spaced 4 inches on center where the ultimate design wind speed is 130 mph or greater but less than 140 mph.

g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C208.

h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.

i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

j. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.

Commenter's Reason: This public comment adds language to footnote a in order to clarify that the table pertains to carbon steel fasteners and connections and clarifies that the code change, as approved by the CAH, deletes stainless steel nails and staples from the table. The added language is proposed because if is feared that users of the code will easily miss this change, and not necessarily understand that stainless steel (or other materials) may not perform the same as carbon steel. These other materials may require differences in deign to achieve equivalent performance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed comment does not add additions requirements, but rather clarifies that stainless steel (and other materials) required different considerations due to the differences in strength and withdrawal characteristics. Since stainless steel is being deleted in the approval in the CAH, this comment only provides clarification and does not add any cost effects to what is already accepted.

Public Comment# 2135

RB203-19

IRC®: TABLE R602.10.3(3)

Proposed Change as Submitted

Proponents: Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

2018 International Residential Code

Revise as follows:

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

Portions of table not shown remain unchanged.

• SOIL CLASS D[b]• WALL HEIGHT = 10 FEET• 10 PSF FLOOR DEAD LOAD• 15 PSF ROOF/CEILING DEAD LOAD• BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, f]				
Seismic DesignCategory	Story Location	Braced Wall LineLength(feet)[c]	Method LIB[d]	Method GB	MethodsDWB, SFB, PBS,PCP, HPS,CS-SFB[e]	Methods WSP , PFH, PFG[e], and ABW	MethodsCS-WSP,CS-G, CS-PF

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

a. Linear interpolation shall be permitted.
b. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the International Building Code.
c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.
d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
e. Methods PFG and CS-SFB do not apply in Seismic Design Categories D0, D_1 and D_2.

f. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.

Reason:
Last cycle, the tables for Bracing Requirements Based on Wind Speed and Bracing Requirements Based on Seismic Design Category were revised so that they included all the permissible bracing methods. For some reason, three permissible bracing methods were left off of Table R602.10.3(3). So we are proposing to add methods ABW, PFH, and PFG in to the table in the WSP column heading. ABW, PFH, and PFG are intermittent bracing methods that have amounts of bracing based on their equivalency to a WSP braced wall panel.
Note that Method PFG is only permitted in Seismic Design Categories A, B, and C per Section R602.10.6, but footnote e already reflects that. so the only action needed is to add the reference to footnote e. This method has to be listed because there are also requriements for Townhouses in SDC C in this table.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is meant to only clarify that Braced Wall Panel methods ABW, PFH, and PFG are permitted to be used in SDC C townhomes and that ABW and PFH are permitted to be used in Seismic Design Categories D0, D1, and D2. If anything, there could be a decrease in cost if builders were able to use a more economical method because of this clarification.

RB203-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The proposal will increase bracing method options. The limitations of the PFG limitations are addressed in footnote e. (Vote: 10-0)

Assembly Action: **None**

RB203-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R602.10.3(3)

Proponents:
Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D[b]• WALL HEIGHT = 10 FEET• 10 PSF FLOOR DEAD LOAD• 15 PSF ROOF/CEILING DEAD LOAD• BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, ~~f~~ g]				
Seismic DesignCategory	Story Location	Braced Wall LineLength(feet)[c]	Method LIB[d]	Method GB	MethodsDWB, SFB, PBS,PCP, HPS,CS-SFB[e]	Methods WSP, PFH[f], PFG[e,f], and ABW[f]	MethodsCS-WSP,CS-G, CS-PF

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class “D.” Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the International Building Code.

c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.

d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

e. Methods PFG and CS-SFB do not apply in Seismic Design Categories D0, D_1 and D_2.

f. Methods PFH, PFG and ABW are only permitted on a single story or a first of two stories.

~~f.~~ g. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.

Commenter's Reason: This Public Comment proposes further modification of a Proposal that was approved at the Committee Action Hearings. The original proposal added three bracing methods, PFH, PFG, and AWB, to the heading of the seismic bracing length table. This Public Comments seeks to add a footnote to describe the limitations that are placed on the locations of these bracing methods. All these bracing methods are only permitted on one story buildings or on the first of two-story buildings. However, this table has other entries, including first of three-story buildings, that are not permitted for these bracing methods. In order to avoid the confusion of a possible code conflict, it is proposed to add these limitations as a footnote to this table to make sure it is understood that not all the rows in the table will be applicable to this method. This also will reinforce these limitations because they are only explicitly stated in the description of the specific bracing method for one of the three methods.
For current (2018 IRC) limitations of Method PFH, see Table R602.10.5. For current limitations of Method ABW, see Table R602.10.6.1. For current limitations of Method PFG, see text in Section R602.10.6.3.

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 has no cost impact. It is just editorially clarifying requirements for where the methods may be installed. There is no intent to change code requirements.

Public Comment# 2056

RB212-19 Part I

IRC: R602.13 (New)

Proposed Change as Submitted

Proponents: Vladimir Kochkin, Home Innovation Research Labs, representing Home Innovation Research Labs (vkochkin@homeinnovation.com); Patricia Gunderson, Home Innovation Research Labs, representing Home Innovation Research Labs (pgunderson@homeinnovation.com)

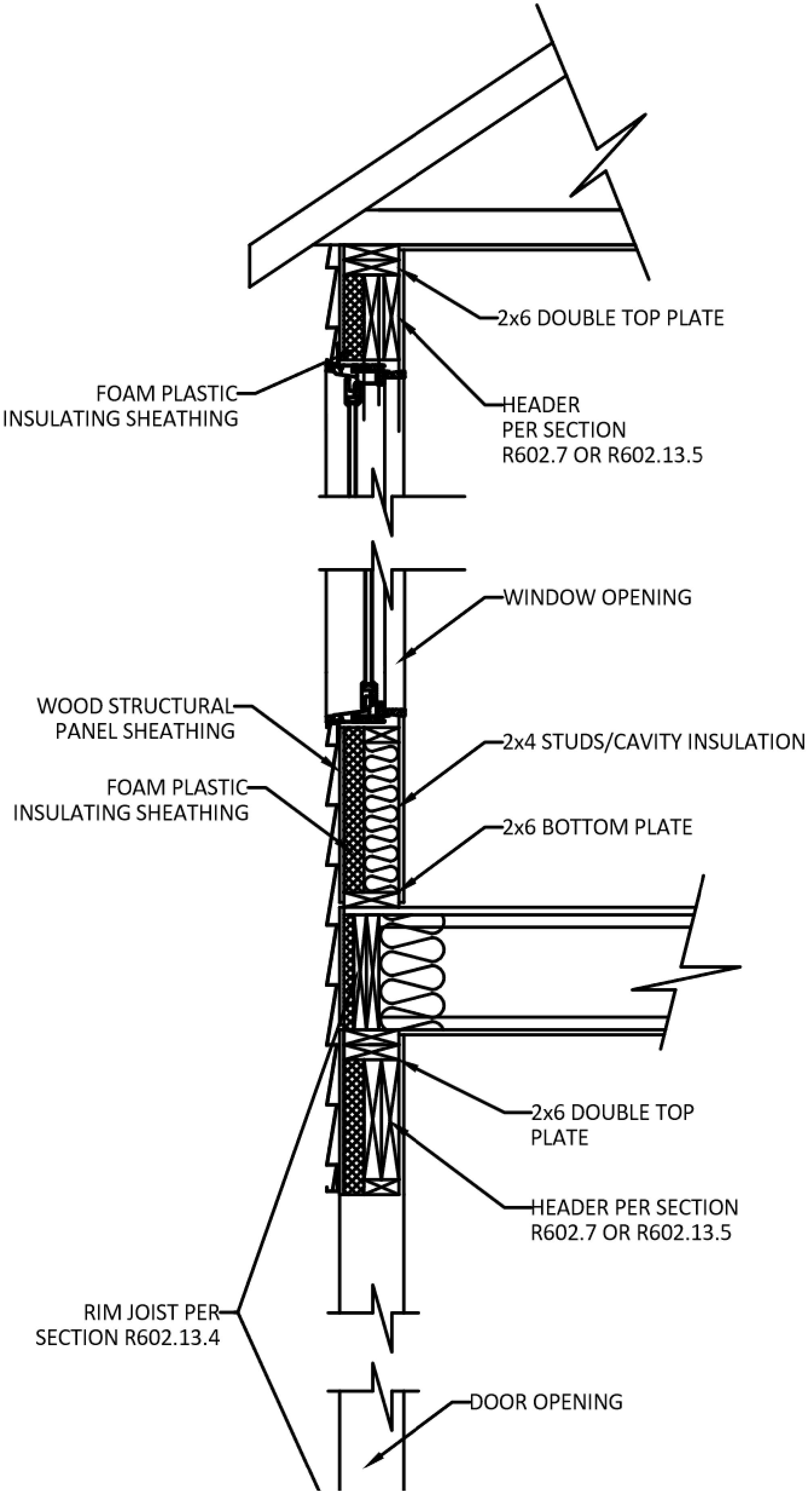
THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IRC-BUILDING COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Residential Code

Add new text as follows:

R602.13 **Extended Plate Wall.** Extended plate wall (EPW) construction shall comply with all applicable provisions of Sections R602.1 through R602.12 as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Categories A, B, and C for detached one- and two-family dwellings and to Seismic Design Categories A and B for townhomes.

R602.13.1 **Framing.** The 2x6 top and bottom plates and 2x4 studs shall be used in accordance with Figures R602.13.1(1) and R602.13.1(2). A single top plate shall not be permitted.


2x6 DOUBLE TOP PLATE
FOAM PLASTIC
INSULATING SHEATHING
HEADER
PER SECTION
R602.7 OR R602.13.5
WINDOW OPENING
WOOD STRUCTURAL
PANEL SHEATHING
2x4 STUDS/CAVITY INSULATION
FOAM PLASTIC
INSULATING SHEATHING
2x6 BOTTOM PLATE
2x6 DOUBLE TOP
PLATE
HEADER PER SECTION
R602.7 OR R602.13.5
RIM JOIST PER
SECTION R602.13.4
DOOR OPENING

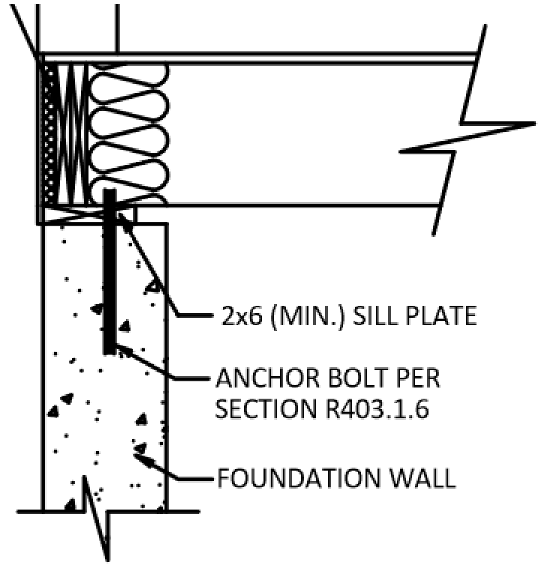


Figure R602.13.1(1)
Extended Plate Wall (EPW) System, Section View

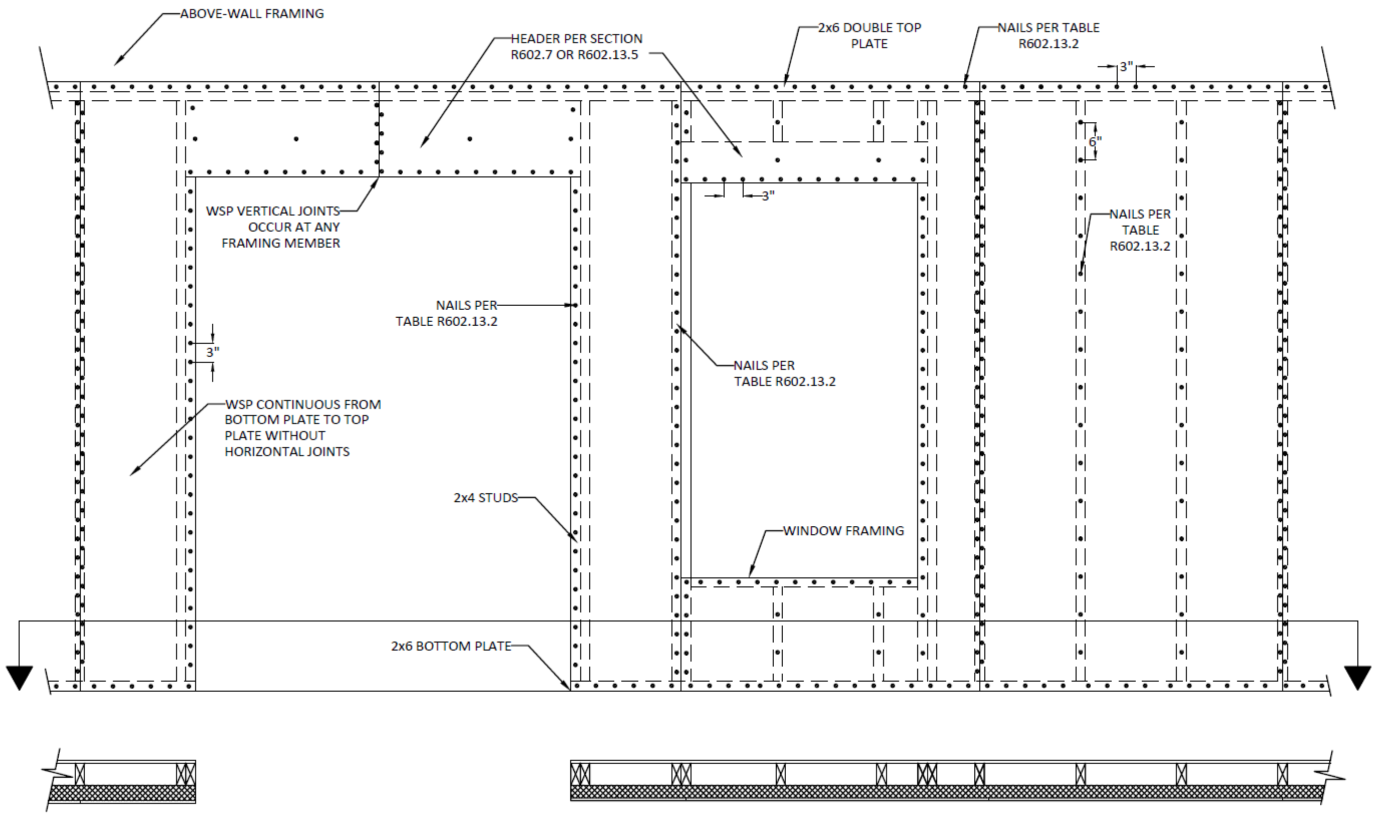


Figure R602.13.1(2)
Extended Plate Wall, Elevation View

R602.13.2 Wood structural panel sheathing. Wood structural panel sheathing with a minimum nominal thickness of 7/16-inch (11 mm) shall be installed vertically and attached to wall plates and studs per Table R602.13.2 and Figure R602.13.1(2). The vertical joints between adjacent wood structural panels shall occur only at framing members. Where used as part of wall bracing, each wood structural panel shall be continuous, without horizontal joints between the extended top and bottom plates.

TABLE R602.13.2.
Sheathing Fastener Requirements for EPW

	Maximum Fastener Spacing	
Minimum Nail Length and Diameter	**At Perimeter of Wood Structural Panels (inches)**	**In Field of Wood Structural Panels (inches)**
No. 37 Power-tool Driven Common Nail (3-1/2" x 0.131")[a,b,c, d]	3 O.C.	6 O.C.
16d Box Nail (3-1/2" x 0.135")[a,b,d]	3 O.C.	6 O.C.

For SI: 1-inch = 25.4 mm

a. Where wood structural panel nominal thickness exceeds 1/2 inch (13 mm), the minimum nail length shall be increased by 1/4 inch (6 mm).

b. At top and bottom plates where the wood structural panel is in direct contact with the framing, 8d common nail (2-1/2" x 0.131") shall be permitted.

c. Full round head nail with minimum head diameter of 0.281 inches (7 mm).

d. Nails are in accordance with ASTM F1667.

R602.13.3 **Wall bracing.** Wall bracing for EPW shall be in accordance with the requirements for WSP or CS-WSP or CS-G bracing methods in Section R602.10 except the sheathing fasteners shall be in accordance with Table R602.13.2.

R602.13.3.1 **Simplified wall bracing.** With the exception of Section R602.12.2 Item 2, provisions of Section R602.12 shall be applicable to the EPW. The fastening schedule for wood structural panels shall be in accordance with Table R602.13.2.

R602.13.4 **Rim joist.** Sawn 2x lumber or engineered wood rim board shall be used to construct rim joists. Engineered wood rim board shall be in compliance with Section R602.1.7. The minimum bearing length requirements for the floor joists shall be satisfied or joists shall be supported with metal hangers. Rim joist (band joist) supporting an EPW shall be in accordance with one of the following methods.

1. A double member rim joist installed flush to the exterior face of the wall in accordance with Figure R602.13.4(1). The thickness of individual rim joist members shall not be less than 1-1/2 inches (38 mm).
2. A double member rim joist recessed by 1 inch (25 mm) from the exterior face of the wall in accordance with Figure R602.13.4(2). The thickness of individual rim joist members shall not be less than 1 inch (25 mm). Foam plastic insulative sheathing shall be installed in the 1 inch (25 mm) recess.
3. Approved engineered design.

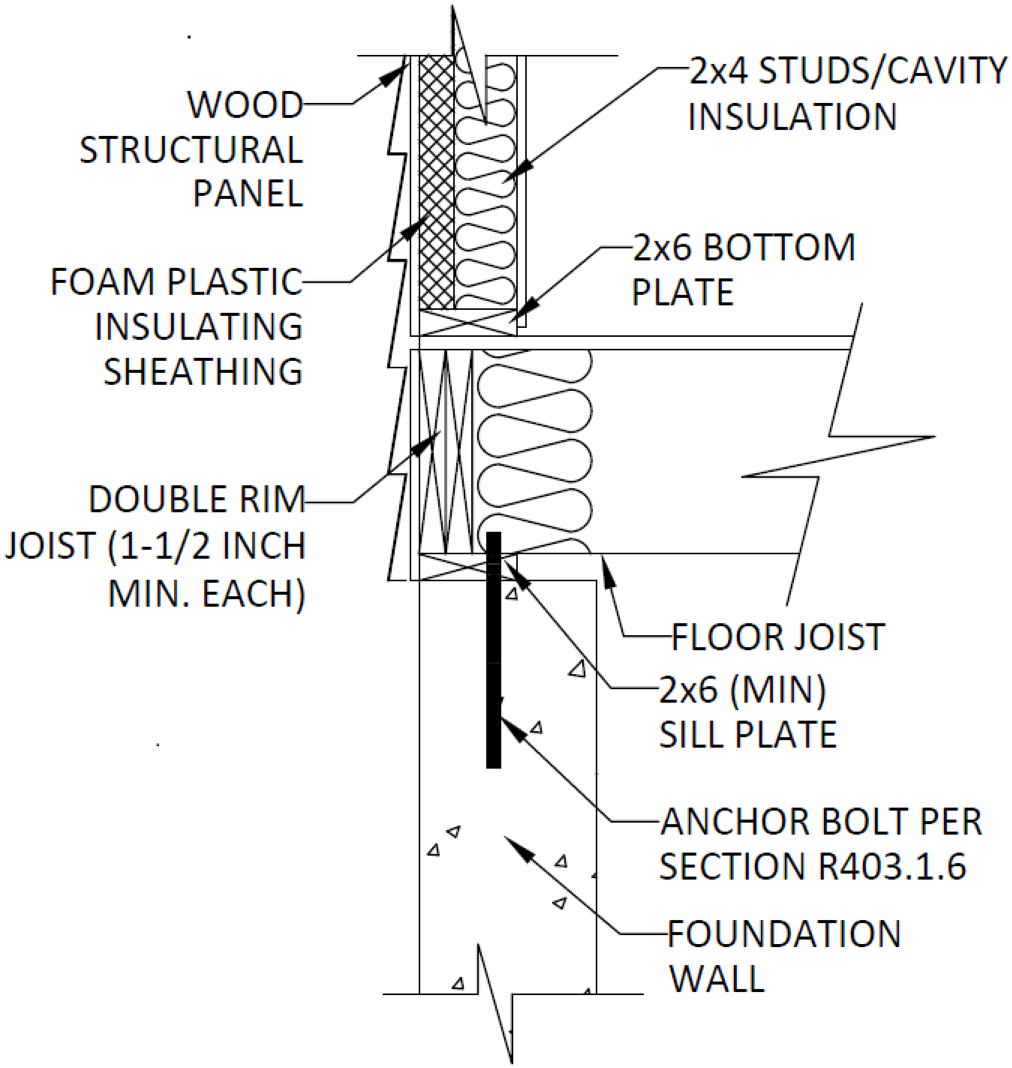


Figure R602.13.4(1)
Rim Joist Construction for EPW – Double Member

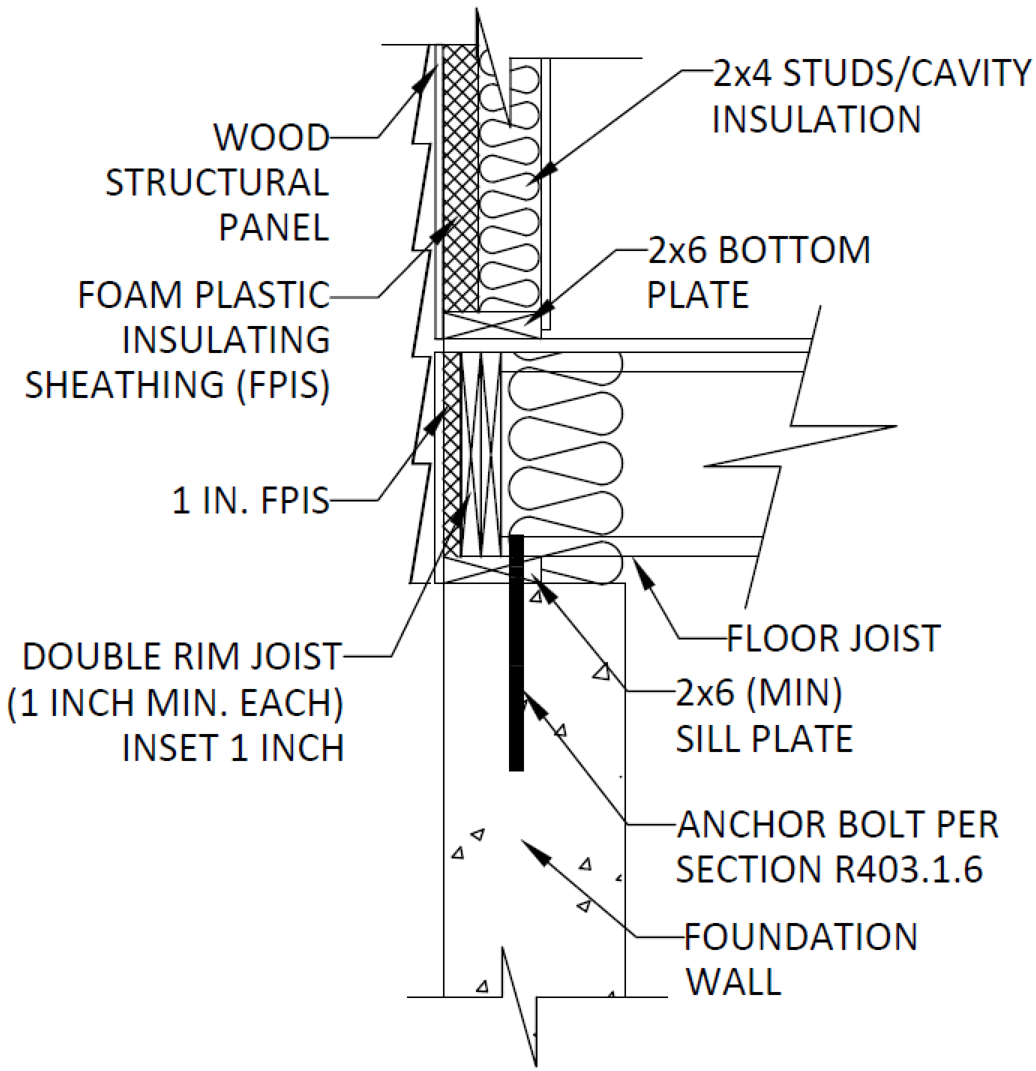


Figure R602.13.4(2)
Rim Joist Construction for EPW – Inset Double Member

R602.13.5 Rim joist used as rim header. Wood rim boards, or band joists, that serve as rim board headers shall be constructed in accordance with Section R602.7.2.

R602.13.6 Foam plastic insulating sheathing. Foam plastic insulating sheathing (FPIS) with a total thickness of 2 inches (51 mm) shall be installed between top and bottom plates directly to the exterior surface of studs and flush with the 2x6 top and bottom plates. FPIS shall comply with ASTM C578 or ASTM C1289, with a minimum compressive strength of 15 psi. FPIS shall be permitted to be installed in one or more layers.

R602.13.7 Wall coverings. Interior and exterior coverings and wall finishes shall be in accordance with all applicable provisions of Sections R701 through R703 as modified by the provisions of Sections R602.13.7.1 and R602.13.7.2.

R602.13.7.1 Vapor retarder. A vapor retarder on the interior side of the EPW frame shall be in accordance with Section R702.7. Where a Class III interior vapor retarder is used in accordance with Table R702.7.1, EPW shall be designated as a 2x4 wall with continuous insulation and, in Climate Zones 4, 5, 6, 7, and 8, the foam plastic insulating sheathing layer including any facers or surface film shall have a water vapor permeance of less than or equal to 1.5 perms.

R602.13.7.2 Cladding attachment. Cladding shall be specified and installed in accordance with Section R703 and one of the following:

1. Table R703.3.3 for siding attachment to wood structural panels only.
2. Table R703.8.4(2) for brick tie-spacing and attachment to wood structural panels only.
3. Fastening schedule and fasteners as required by Table R703.3.(1), except fastener length shall be selected to meet or exceed the minimum required penetration into framing.

R602.13.8 Uplift connections. Where roof uplift tie-downs are selected in accordance with Section R802.11, the roof tie-downs shall be fastened to either side of the double top plate or, if required to be fastened to studs, shall be installed from the interior face of the wall in accordance with manufacturer's installation instructions. Where uplift forces determined in accordance with R602.3.5 require approved uplift connectors between floors or between foundation and the floor, these uplift connectors shall not rely on wood structural panel sheathing for resisting roof wind uplift forces.

Reason: The Extended Plate Wall (EPW) provides a compliance option for meeting energy code requirements for above-grade walls. In addition, it provides a construction option for many above-code energy efficiency and green programs. EPW represents a method of construction that uses standard framing, sheathing, fastening, and insulating materials configured for optimized constructability and performance. EPW preserves many traditional construction practices while achieving better levels of energy performance. The system has been extensively evaluated over the course of 5 years for its structural performance, moisture performance, energy performance, and constructability in the field. The evaluations have been funded by the USDA's Forest Products Laboratory, U.S. Department of Energy, New York State Energy Research and Development Authority, and American Chemistry Council. Four demonstration homes have been constructed and are now occupied. The wall system can be assembled in the field or fabricated in a factory for on-site installation. Results of evaluations and structural testing, background information, and design and construction guidance are available at www.homeinnovation.com/EPW. Based on the scope of the evaluations, the proposed system is limited to low-seismic and low-wind areas.

Bibliography: www.homeinnovation.com/EPW

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal adds a new optional solution for achieving compliance with current energy code provisions.

RB212-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The committee has several concerns with the proposal as follows: foam is not structural; this needs to be an engineered system; there are concerns for uplift; point loads from roof trusses could be detrimental to the plate wall; the proposal is not clear for the nailing between the 1st and 2nd floor. (Vote: 10-1)

Assembly Action: **None**

RB212-19 Part I

Individual Consideration Agenda

Public Comment 1:

IRC®: R602.13 (New)

Proponents:
Vladimir Kochkin, representing Home Innovation Research Labs (vkochkin@homeinnovation.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R602.13 Extended Plate Wall. Extended plate wall (EPW) construction shall comply with ~~all applicable~~ the provisions of Sections R602.1 through R602.12 except as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Categories A, B, and C for detached one- and two-family dwellings and to Seismic Design Categories A and B for townhomes.

Commenter's Reason: Requesting to approve as modified. The modification clarifies the charging language in response to the feedback received

from the committee at the April hearings.
The questions included in the committee's reason are addressed below. More information on the proposed system, its development and evaluation is posted here: www.homeinnovation.com/epw. Because of a publishing error, the reason statement was not included in the proposal monograph or the errata contributing to a lack of clarity during the committee deliberations. The primary goal of the proposed provisions is to include an option for an energy efficient wall constructed using conventional framing methods with a few basic modifications.

By including the proposed provisions in the IRC, the designer is provided with a prescriptive solution for constructing a standard house up to two stories in height. As with any other system in the IRC, there is always an option to engineer specific details for more complex house configurations. The system is designed not to rely on the foam for structural capacity. The system has been extensively tested and several demonstration homes have been constructed. The structural performance meets and, in most cases, exceeds the minimum performance requirements. The uplift requirements are specifically addressed in section R602.13.8 of the proposed provisions and the system is limited to the wind zones within the prescriptive limitations of the IRC. Construction practices for supporting points loads are the same as with a standard 2x4 stud wall system as required in Chapter 6 of the IRC. The nailing between stories is also the same as for any standard wood-frame wall system in Chapter 6 of the IRC.

Bibliography: www.homeinnovation.com/EPW

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal provides a new construction option for compliance with the energy code. It does not impose any new requirements.

Public Comment# 1643

Public Comment 2:

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

requests As Submitted

Commenter's Reason: The proposal should be approved as submitted to agree with committee action on RB212 Part 2 recommending approval as submitted. The RB committee discussion and reason for disapproval did not properly represent the merits of the proposal and there was no opportunity to address concerns brought up or clarified after testimony during committee discussion. Thus, a response to the committee's reason statement is addressed below.
First, the whole reason for the extended plate wall technology is because "*foam is not structural*". Consequently, it does not rely on the foam being used in a structural capacity. Instead the extended plate wall integrates foam sheathing into conventional wood framing and under wood sheathing to minimize structural impact and improve overall constructability by allowing wood sheathing to serve both as a structural bracing material and as a nail base material directly behind cladding. The wall system has been engineered, tested for shear and gravity loading, and proven in four case studies of actual homes built using the technology. Like conventional wood framing, it does not "*need to be an engineered system*" for every use which creates and unnecessary barrier to innovation by putting this new wall construction technology using commodity materials at an economic disadvantage. Instead, the engineering knowledge behind this non-proprietary technology was used to develop prescriptive provisions for use, as done for conventional wood framing, steel framing, insulating concrete forms, structural insulated panels and other technologies included in the IRC.

Regarding "*point loads from roof trusses*", roof trusses and girder trusses (or point loads in general) are handled the same as a conventional 2x4 wall. There is no difference created and the same practices and limitations in the code for 2x4 wall construction to resist gravity and wind loads are applicable to the extended plate wall technology as proposed. A stack of multiple built-up studs or use of a column are typical solutions applicable to both extended plate walls and conventional wood framing without extended plates. Regarding "*concerns for uplift*" and "*nailing between 1st and 2nd floor*", there is no difference with regard to conventional 2x construction since the same fastening schedule is required for plates to roofs and floors. In addition, there are suitable proprietary connectors available where additional uplift or shear capacity is needed, just as the case with conventional wood framing without extended plates. In cases where wind or seismic loads are out-of-scope of the IRC prescriptive provisions, an engineered design would be required, just as it is for other construction methods recognized in the IRC.

Finally, the proposal has been vetted through various experts, has sought and considered input from interested parties, and has been proven ready for adoption through four actual case study homes including site built and panelized construction. We urge your support as this proposal provides a useful option for wall construction to satisfy the structural requirements of the IRC and the energy code requirements of the IECC.

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 (and this PC for as submitted) has at worst no cost impact because it is adding an optional construction method to the code. However, it may reduce cost for applications where continuous insulation is being used for energy code compliance or improved thermal and moisture performance.

Public Comment# 1625

Public Comment 3:

Proponents:
David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: The American Wood Council (AWC) supports the action for DISAPPROVAL and shares many of the concerns which have already been identified by the IRC-B committee. With the complexity of the requirements for sheathing nailing, framing alignment for gravity, and load path for wind uplift, we feel the proposed system should be addressed through an engineering analysis.
Based on the committee reason statement, AWC supports the committee action for DISAPPROVAL.

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# 1574

RB212-19 Part II

IECC®: R402.1.6 (New), TABLE R402.1.2

Proposed Change as Submitted

Proponents: Vladimir Kochkin, Home Innovation Research Labs, representing Home Innovation Research Labs (vkochkin@homeinnovation.com); Patricia Gunderson, Home Innovation Research Labs, representing Home Innovation Research Labs (pgunderson@homeinnovation.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.1.6 **Extended Plate Wall (EPW).** EPW wall systems constructed in accordance with all applicable provisions of Sections R602.1 through R602.13 of the International Residential Code shall be considered to be in compliance with continuous insulation provisions of Table R402.1.2. For use with the prescriptive minimum insulation requirements, the foam plastic insulating sheathing layer installed outboard of the studs and the cavity insulation shall be in accordance with the required levels of insulation specified in Table R402.1.2.

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h, i]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h, i]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h, i] or 13+10[h, i]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h, i] or 13+10[h, i]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. <u>EPW wood-frame wall system utilizing foam plastic and cavity insulation equal to or exceeding the prescribed R-values shall satisfy the prescriptive minimum insulation requirements for CZ 3-8.</u>

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: The change is a useful solution for flexibility in design and efficiency (Vote: 7-4).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
Matt Archer, representing City of Lone Tree (matt.archer@cityoflonetree.com)

requests Disapprove

Commenter's Reason: Part II will need to be disapproved if Part I is not approved at Public Comment. Without Part I, Part II is meaningless and cannot be applied.

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# 2127

Public Comment 2:

Proponents:
David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: Part 1 of this proposal was recommended for DISAPPROVAL by the IRC-B Committee (10-1) for engineering reasons and therefore Section 602.13 would not exist, but would be referenced in this proposal if both Parts I and Part II would follow the recommendation of the committee. In regard to why Part I was disapproved, AWC review shares many of the same concerns identified by the IRC-B Committee. Due to complexity of requirements for sheathing nailing, framing alignment for gravity, and load path for wind uplift we felt this proposed system should be addressed through an engineered design.

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# 1592

RB213-19

IRC®: R608.1

Proposed Change as Submitted

Proponents: Samuel Steele, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

2018 International Residential Code

Revise as follows:

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ~~or~~ ACI 318, or ACI 332. Where PCA 100, ACI 318 , ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

Reason: This change updates the exterior concrete wall construction section, R608.1, by including a reference to ACI 332 Residential Code Requirements for Structural Concrete. ACI 332 addresses the design and construction concrete basement or foundation walls constructed with removable forms or with flat insulating concrete forms. ACI 332 is already a referenced standard in section R404.1.3 of the 2018 IRC which also deals with the design of concrete foundation walls.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It simply puts in a reference to a standard that was overlooked.

RB213-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The proposal provides for options consistent with ACI. (Vote: 11-0)

Assembly Action: **None**

RB213-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R608.1, R608.5.1

Proponents:
Jenifer Gilliland, representing Seattle Department of Construction and Inspections (SDCI) (jenifer.gilliland@seattle.gov); Samuel Steele, Seattle Department of Construction and Inspections, representing Seattle Department of Construction and Inspection (SDCI) (samuel.steele@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ACI 318,or ACI 332. Where PCA 100, ACI 318, ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

R608.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall conform to requirements of this section, PCA 100, ~~or~~ ACI 318 , or ACI 332.

Commenter's Reason: The original code change proponent requests that a reference to ACI 332 Residential Code Requirements for Structural Concrete be added to a code section that was overlooked when the code change was drafted. This reference allows concrete, or materials used in concrete, to comply with ACI 332 where used in the design of exterior concrete walls. The ability to design to ACI 318 or PCA 100 is retained.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Adding a reference from this section to ACI 332 further clarifies that exterior concrete walls in residential construction can be designed using ACI 332 instead of ACI 318. Designers will choose the most cost effective standard for the project, potentially resulting in a decrease in the cost of construction.

Public Comment# 1242

RB219-19

IRC: R702.7, R702.7.3

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

R702.7 Vapor retarders. Class I, ~~or~~ II or III vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

R702.7.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met.

TABLE R702.7.1
CLASS III VAPOR RETARDERS

Portions of table not shown remain unchanged.

CLIMATEZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a]

R702.7.2 Material vapor retarder class. The *vapor retarder class* shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

1. Class I: Sheet polyethylene, on perforated aluminum foil.
2. Class II: Kraft-faced fiberglass batts.
3. Class III: Latex or enamel paint.

Revise as follows:

R702.7.3 Minimum clear airspaces and vented openings for vented cladding. ~~For the purposes of this section, vented~~ Vented cladding shall include ~~the following minimum clear airspaces.~~ a minimum 3/16-inch (4.8 mm) airspace. Other openings with the equivalent vent area shall be permitted.

1. ~~Vinyl polypropylene or horizontal aluminum siding applied over a weather-resistive barrier as specified in Table R703.3(1).~~
2. ~~Brick veneer with a clear airspace as specified in Table R703.8.4(1).~~
3. ~~Other approved vented claddings.~~

Reason: First, as written the section title R402.7.3 **Minimum clear airspaces and vented openings for vented cladding** does not match the code language below which is defining vented cladding. It appears that vented cladding is being used as an example of what minimum clear air spaces is but it is very confusing and most are unclear what the section is trying to do. If vented cladding needs to be defined a new section should be create to do so. In my option it does not need to be defined, but the minimum clear airspace certainly does.
As we know vapor retarders are designed to stop or limit the amount of moisture that can diffuse into a building assembly. They however do not stop moisture that moves with air and science has determined that 90 plus percent of the moisture that enters our building assemblies gets there via air leakage vs. vapor diffusion. Therefore, our concern regarding trapping moisture in assemblies and the drying potential of the assemblies we build is on the rise. With that in mind this proposal is striving to attain two things. First a realization that the choice of vapor retarder that is used should be based on the structure and the climate that structure is built in. We should dictate that a vapor retarder is installed, but not proclaim that only one type is best for a specific climate zone. Second, specifically when class three vapor retarders are used it has been shown that the vented space does not need to be more than 3/16 of an inch. The structure of the code does not called out the size of the vented opening which is causing builders to be forced to use class one and two vapor retarders when class three retarders would actually be the best choice for their climate and structure. This occurs because jurisdictions do not have better guidance than some random examples of gaps size behind vented cladding that is currently given in the code. This is especially true in dry climate zones but is an issue everywhere.

In Joe Lstiburek's article titled "Wufi – Barking up the Wrong Tree" he demonstrates that wood siding that is installed over a 3/16" gap has air movement behind it that is equivalently to approximately 20 air changes per hour. See table 2 cladding ventilation/sheathing ventilation. Lstiburek continues in his article titled, "Hockey Pucks and Hydrostatic Pressure" to demonstrate the "you need to install wood siding and trim over a small gap to control hydrostatic pressure. This gap can be as small as ¼" and the spacer can be a strip of thin foam" such as sill seal which is what is pictured in the photographs that accompany the paper.

Bibliography: BSD-106: Understanding Vapor Barriers, by Joseph Lstiburek
http://buildingscience.com/documents/digests/bsd-106-understanding-vapor-barriers

BSI-089: Wufi – Barking up the Wrong Tree, by Joseph Lstiburek

https://buildingscience.com/documents/building-science-insights-newsletters/bsi-089-wufi%E2%80%94barking-wrong-tree

BS_-057: Hockey Pucks and Hydrostatic Pressure, by Joseph Lstiburek

https://buildingscience.com/documents/insights/bsi-057-hockey-pucks-and-hydrostatic-pressure

RR-0999: Drainage Planes and Air Spaces, by Joseph Lstiburek

https://buildingscience.com/documents/reports/rr-9909-drainage-planes-and-air-spaces/view

You don't need a Vapor Barrier, By Allison Bailes with the Energy Vanguard

http://www.energyvanguard.com/blog-building-science-HERS-BPI/bid/54110/You-Don-t-Need-a-Vapor-Barrier-Probably

Are Vapor Barriers Required or Recommended?

BY JUAN RODRIGUEZ Updated December 30, 2018

https://www.thebalancesmb.com/what-is-a-vapor-barrier-845075

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

There are no construction cost increases associated with the clarification and flexibility that are achieved through this code change proposal

RB219-19

Public Hearing Results

Errata: This proposal includes the following errata
In Section R702.7.3 Item 2, the correct reference is Table R703.8.4<u>(1)</u>.

Committee Action: **Disapproved**

Committee Reason: The committee felt that the proposal could be further clarified to make it clear that these provisions apply only to Class III vapor retarders. Further, the cost impact says there is no cost impact, but the committee felt that there would be an increase in cost with this proposal. (Vote: 9-2)

Assembly Action: **None**

RB219-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R702.7.3

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R702.7.3 Minimum clear airspaces and vented openings for vented cladding. Vented cladding shall include a minimum 3/16-inch (4.8 mm) airspace. Other openings with the equivalent vent area shall be permitted.

1. <u>Vinyl polypropylene or horizontal aluminum siding applied over a weather-resistive barrier as specified in Table R703.3(1).</u>

2. <u>Brick veneer with a clear airspace as specified in Table R703.8.4(1).</u>

3. <u>Other approved vented claddings.</u>

Commenter's Reason: The committee felt that this proposal could be further clarified to make it clear that these provisions apply only to Class III vapor retarders. From a code perspective, vented cladding is only required when a class III vapor retarder is used. Section R702.7.1 Class III vapor retarders is specific states that, “Class III vapor retarders shall be permitted where any one of the conditions in Table R702.7.1 is met.” The table specifically defines vented cladding assemblies that can be built when using a Class III vapor retarder. There is no clarification of assemblies in this section for the other two classes of retarder. This code change proposal clarification of the size of the air space required when using a vented cladding can only be defining the vented air space required when class III vapor retarders are used.

Further, the cost impact says there is no cost impact, but the committee felt that there would be an increase in cost with this proposal. There could be a cost increase but the reality is that an air space is currently required in order to build with a class III vapor retarder so it is unlikely that an increase in cost would be associated with the clarification of the size of the air space that is needed. This is why the cost statement stated that no construction cost increase would be associated with the clarification and flexibility that are achieved through this code change proposal.

The Public Comment does bring back a section of code language that was added back in by floor modification Weston-1 and was heard by the committee. This is in Section 702.7.3 and the language that was added back in this public comment has been underlined.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There are no construction cost increases associated with the clarification and flexibility that are achieved through this code change proposal

Public Comment# 1838

RB221-19

IRC: R702.7, R702.7.4(New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

2018 International Residential Code

Revise as follows:

R702.7 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4 to protect the exterior wall assembly against condensation. Vapor retarders shall be installed in accordance with Section R702.7.4.

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

Add new text as follows:

702.7.4 Installation Vapor retarders shall be installed in accordance with the manufacturer's instructions or an approved design. The vapor retarder shall be installed as an air barrier or in conjunction with an air barrier.

Reason: For vapor retarders to perform as intended, they need to be installed as or in conjunction with an air barrier.
Air leakage control is currently dealt with in the I-codes based on energy efficiency considerations, but it is also critical to protection against moisture condensation. Air leakage can move 100x more moisture than vapor diffusion, and vapor retarders will not work properly without air leakage control. As stated in the Whole Building Design Guide:

"Moisture contributed by air leakage is a significant source and should be a serious concern in the design of the wall system. In fact, the design of the building envelope for minimizing air leakage is more critical than the design of the vapor barrier. To illustrate this point, consider that the amount of moisture contributed to a building by the air that flows through a crack 1/16th inch thick by 1 foot long is just over 5 pints per day in a light breeze. In contrast, the amount of moisture contributed by vapor diffusion through a 10 foot by 50-foot painted block wall over the same period equals just under 1/3 of a pint (about 5 ounces)."

It is important to include air leakage control in Section R702.7 as it will highlight its importance to moisture management and facilitate the inclusion of air leakage control in water management details.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal should neither increase nor decrease the cost of construction, as its intention is to ensure that an existing requirement is installed in an effective manner.

RB221-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal was disapproved because "approved design" is too broad and unclear. (Vote: 9-2)

Assembly Action: **None**

RB221-19

Individual Consideration Agenda

Public Comment 1:

IRC®: 702.7.4 (New)

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

702.7.4 Installation Vapor retarders shall be installed in accordance with the manufacturer's instructions ~~or an approved design~~. The vapor retarder shall be installed as an air barrier or in conjunction with an air barrier.

Commenter's Reason: The committee expressed concerns about meaning of "an approved design" at the Committee Action Hearing and indicated they would like to see a public comment. This proposal addresses the committee concerns by removing the language. Please refer to the original reason statement regarding the intent of this 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 should neither increase nor decrease the cost of construction, as its intention is to ensure that an existing requirement is installed in an effective manner.

Public Comment# 2028

RB231-19

IRC®: R703.2

Proposed Change as Submitted

Proponents: Paul Coats, representing American Wood Council (pcoats@awc.org)

2018 International Residential Code

Revise as follows:

R703.2 Water-resistive barrier. One layer of No. 15 asphalt felt, free from holes and breaks, complying with ASTM D226 for Type 1 felt or other approved water-resistive barrier shall be applied over studs or sheathing of all exterior walls. No.15 asphalt felt shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches (51 mm). Where joints occur, felt shall be lapped not less than 6 inches (152 mm). Other *approved* materials shall be installed in accordance with the *water-resistive barrier* manufacturer's installation instructions. The No. 15 asphalt felt or other approved *water-resistive barrier* material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.

Exception: A water-resistive barrier shall not be required in detached accessory structures that are not heated or cooled.

Reason: For many years the code exempted accessory structures from the requirement for a water resistive barrier. The exception was removed from the code in the previous cycle, but the exception that was removed applied to all accessory structures, regardless of their purpose and regardless of whether they were heated or cooled. This proposal will not exempt conditioned (heated or cooled) accessory structures, which are more subject to movement of moisture through the exterior walls than unconditioned ones. Unconditioned detached accessory structures such as sheds and storage structures have a proven record of performance when complying with the normal siding installation requirements without a water resistive barrier as defined in the code. Unconditioned structures are typically used to store yard tools, lawn mowers, tractors, hay, boats, road salts, including certain amounts of fume-producing fuels and lubricants. They often do not have interior wall coverings or insulation, but instead have exposed framing with siding and no wall sheathing. Installing a water resistive barrier directly to framing without wall sheathing is difficult, and the barrier would be easily punctured by yard tools or other objects leaning against the walls. In addition, they could hinder the natural ventilation needed to disperse fumes and heat. Structures that are heated or cooled are more likely to have insulation and therefore the water resistive barrier makes sense, but an exception is needed for unconditioned structures which have been adequately served by the siding provisions in the code.

Cost Impact: The code change proposal will decrease the cost of construction
This may decrease the cost of construction for certain unconditioned accessory structures.

RB231-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The committee felt that this was a reasonable allowance for small accessory structures that will typically not have interior finishes. (Vote: 6-4)

Assembly Action: **None**

RB231-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests Disapprove

Commenter's Reason: The committee vote was 6-4 in support of this proposal as submitted. We are requesting disapproval given the obvious potential for structural sheathing water damage due to the added exposure to liquid water without a water-resistive barrier.

Water-resistive barriers are needed for both conditioned and unconditioned structures. A water-resistive barrier is designed to act as a secondary drainage plane for liquid moisture that gets behind the cladding in conditions such as wind-driven rain. There is no evidence submitted that unconditioned structures have less exposure in the secondary drainage plane compared to conditioned structures. Therefore, the assumption is that there is sufficient drying potential with an empty cavity to offset the added wetting potential without the water-resistive barrier.

There is precedence for this approach based upon historical experience with open stud construction, where the exterior sheathing is directly exposed to an open cavity. We oppose this code change because there is no requirement for open stud construction in this proposal. The addition of interior insulation, vapor barrier, gypsum, etc., could limit the drying potential and have unintended consequences.

The historical practice of open stud construction is detached structures does not necessarily predict the future use of these structures, given the rising cost of construction, multi-generational housing, working at home and the need to convert unfinished to finished spaces to avoid having to relocate to a larger home. Tiny homes and storage shed home offices have emerged as practical solutions to these issues. Detached structures should be protected by a minimal cost water-resistive barrier that will protect the structure over its lifetime.

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# 2030

RB238-19

IRC®: R703.4

Proposed Change as Submitted

Proponents: Donald Sivigny, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Residential Code

Revise as follows:

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. <u>An insulation stop shall be installed around all window and door openings, 1 to 2 inches inward from the face of the exterior sheathing, to allow for drainage of incidental water at the window or door flashing system.</u> Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.

   1.2. In accordance with the flashing design or method of a registered design professional.

   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Reason: This change will increase the durability of the wall assembly when integrating a fenestration product into the assembly. This code change will enhance the opportunity for water drainage in accordance with the remainder of Section R703.4 to specifically address water drainage at the pan flashing. This proposal provides the opportunity to install fenestration product in compliance with <u>both</u> the Energy Code and the installation instructions of the fenestration manufacturer, by enhancing the drainage of pan flashed fenestration products. The Energy code requires the fenestration products and the framed openings to be insulated and sealed. The installers of these fenestration units almost exclusively use expanding spray foam as a sealant to meet the Energy Codes. When this expanding foam or other sealant flows outward to, or extends to the exterior nailing flange, it actually blocks the free drainage of water to the exterior, allowing water to collect and wick inward through capillary action toward the interior of the exterior wall assembly where it will cause degradation of the wall assembly. Maintaining an unobstructed and drainable air space around the perimeter of the fenestration product, and especially the pan flashing, will allow for convective air flow that promotes drying and will elevate water infiltration to the wall assembly. This can be accomplished by installing a barrier or stop to prevent the expanding foam or other sealants from reaching the interior side of the nailing flange where it will create degradation issues within the wall assembly. Unobstructed drainage is essential to the draining of water where the fenestration products interface with the wall assemblies. The existing code language does not have any specific, or enforceable language to require an unobstructed drainage plane at all fenestration products. This code change proposal does not interfere with or override the specific installation instruction of fenestration products into walls assemblies by the manufacturer or the code, but instead, it simply enhances the ability of the wall assembly to drain water and maintain a dry and durable assembly for years to come.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal initially may increase or decrease the cost of construction slightly in material, depending on the manufacturer's installation instructions, however any increase in these cost will more than recovered in the longevity of the assembly and addressing those problems of degradation of wall assemblies at these openings when it is not allowed to drain fully and stay dry. Remember the cost of a Call back to a home is around $350 or above on average.

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1.Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. ~~An insulation stop~~ Air sealing shall be installed around all window and door openings on the interior side of the rough opening gap.~~, 1 to 2 inches inward from the face of the exterior sheathing, to allow for drainage of incidental water at the window or door flashing system.~~ Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:

1.1.The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
1.2.In accordance with the flashing design or method of a registered design professional.
1.3.In accordance with other approved methods.
2.At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3.Under and at the ends of masonry, wood or metal copings and sills.
4.Continuously above all projecting wood trim.
5.Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6.At wall and roof intersections.
7.At built-in gutters.

Committee Reason: The modification makes the proposal product nuetral, and clarifies that the intent is to allow for water to drain out. The modification also inserts correct code language and has the physics correct. The committee agreed with the intent of the original proposal, but thought it was too limiting without the modification. (Vote: 11-0)

Assembly Action: **None**

RB238-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R703.4

Proponents:
Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to the water-resistive barrier complying with Section 703.2 for subsequent drainage. Air sealing shall be installed around all window and door openings ~~on the interior side of the rough opening gap~~ Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:
   1.1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
   1.2. In accordance with the flashing design or method of a registered design professional.
   1.3. In accordance with other approved methods.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

Commenter's Reason: We are not opposed to the intent of the proposal and appreciate the modification made to the original proposal at the Committee Action Hearings, however after subsequent consideration, further modification to remove “on the interior side of the rough opening gap” is needed. Our concern is the same as for any amendment to R703.4 that may be proposed – provisions that are unclear and/or that may conflict with the manufacturer’s installation instructions. With respect to this proposal, it is not clear exactly what “on the interior side of the rough opening gap” is, therefore leaving it open to interpretation, and it may also conflict with the manufacturers installation instructions covering air sealing around the window or door. The language is simply not needed to accomplish the intent of the proposal and given the potential problems that can result from it, it needs to be removed.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
While not in every case, this proposal will decrease the cost of construction by alleviating unclear language that is open to interpretation which could include installation methods or applications that are not necessary and when there is a conflict with a manufacturer's installation instruction which can result in delays while the matter is being resolved or requiring modifications to the installation instructions when they are not necessary.

Public Comment# 1825

RB241-19

IRC®: R703.7, R703.7.1, R703.7.3, 703.7.3.1 (New)

Proposed Change as Submitted

Proponents: Cesar Lujan, representing National Association of Home Builders (clujan@nahb.org); Gary Ehrlich, National Association of Home Builders, representing National Association of Home Builders (gehrlich@nahb.org)

2018 International Residential Code

R703.7 Exterior plaster (stucco). Installation of exterior plaster shall be in compliance with ASTM C926, ASTM C1063 and the provisions of this code.

Revise as follows:

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. expanded meta , welded wire, or woven wire lath shall be attached to wood framing members with 1$^{1}/_{2}$-inch-long (38 mm), 11-gage nails having a $^{7}/_{16}$-inch (11.1 mm) head, or $^{7}/_{8}$-inch-long (22.2 mm), 16-gage staples, spaced not more than ~~6~~ 7 inches (~~152~~ 178 mm) on center vertically and not more than 24 inches on center horizontally, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

> **Exception:** Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

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

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

Add new text as follows:

703.7.3.1 Furring Where provided, furring between lath and vertical supports or solid sheathing shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum ¾ inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063. Furring shall be spaced a maximum of 24 inches (600 mm) on center horizontally and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Reason: The purpose of this code change is to correlate the requirements for exterior lath and plaster (stucco) with the requirements of ASTM C 926 and C 1063 and recommended practice. The code requirements in the IRC are not in alignment with the reference standards and lack key details needed to insure a good installation and minimize the risk of moisture intrusion.
In particular, the IRC lath attachment requirements state a 6” nail or staple spacing but do not specify direction or what nailing substrates are permitted. ASTM C 1063 specifies a 7” vertical spacing along and 16” to 24” horizontal spacing into wood studs. Without this clear direction in the code, some stucco is being installed with fasteners in a 6” grid pattern (both horizontal and vertical), leading to fasteners penetrating sheathing and providing a path for moisture intrusion behind the WRB and exterior sheathing and causing decay and water damage. The code user is referred to C 1063 for lath attachment requirements for other substrates, and is allowed to omit the lath when permitted by C 1063 for concrete substrates which have been properly prepared such that the plaster will bond directly to the concrete.

Also, the IRC does not currently provide any details for furring. Minimum sizes consistent with other wood furring requirements in the IRC and the minimum channel size from C 1063 are supplied along with the maximum horizontal spacing. Again, the proposed language underscores that furring attachment to metal or wood framing must be into studs. Where furring is required between lath and vertical supports or solid surfaces varies depending on the type of lath or plaster base used and the type of vertical support or surface. Designers and stucco installers should defer to C 1063 and stucco manufacturer instructions for guidance on where furring is required.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change aligns the prescriptive language for exterior lath and plaster in the IRC with the ASTM standards referenced in the section. Since compliance with these standards is already required, this change simply provides clarification for builders, stucco installers and building officials and thus does not increase the cost of construction.

RB241-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. expanded meta l, welded wire, or woven wire lath shall be attached to wood framing members or furring with $1^{1}/_{2}$-inch-long (38 mm), 11-gage nails having a $^{7}/_{16}$-inch (11.1 mm) head, or$^{7}/_{8}$-inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring ~~vertically~~ and not more than 24 inches on center between framing members or furring ~~horizontally~~, or as otherwise approved.Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

~~**703.7.3.1**~~ **703.7.1.1** **Furring.** Where provided, furring ~~between lath and vertical supports or solid sheathing~~ shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum ¾ inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063. Furring shall be spaced a maximum of 24 inches (600 mm) on center ~~horizontally~~ and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

Committee Reason: The modification improved the language related to furring attachments. The new section on furring was relocated to under the existing section on lath for the correct application of requirements. The proposal correlates exterior lath and plaster with the requirements of ASTM C926 and C1063. This will improve the understanding of correct spacing. (Vote: 10-0)

Assembly Action: **None**

RB241-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R703.7.1

Proponents:
Kelly Cobeen, Wiss Janney Elstner Associates, representing Federal Emergency Management Agency and Applied Technology Council Seismic Code Support Committee (FEMA/ATC SCSC) (kcobeen@wje.com); Michael Mahoney, Federal Emergency Management Agency, representing Federal Emergency Management Agency (mike.mahoney@fema.dhs.gov)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. expanded metal, welded wire, or woven wire lath. The lath shall be attached to wood framing members or furring . Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with $1^{1}/_{2}$-inch-long (38 mm), 11-gage nails having a $^{7}/_{16}$-inch (11.1 mm) head, or $^{7}/_{8}$-inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on centeralong framing members or furring and not more than 24 inches on center between framing members or furring , or as otherwise approved.Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C 1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Sections R703.15, R703.16, or R703.17. Where lath is attached to furring installed over foam sheathing, the furring connections shall be in accordance with Sections R703.15, R703.16, or R703.17.

> **Exception:** Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

Commenter's Reason: Table R602.10.4 permits exterior plaster (stucco) as a wall bracing material and references Section R703.7 for framing. RB241, if not modified by this public comment, could result in required wall bracing being installed on wall furring that is perpendicular to and only fastened to supporting framing at 24 inches on center. If this construction were to occur, the stucco would be ineffective as wall bracing. The proposed public comment language makes clear that installation on furring is only permitted where the exterior plaster in not serving as required bracing.

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 permitted an alternative installation. The public comment narrows where the alternative construction is permitted. Neither one should have an impact on construction cost.

Public Comment# 1407

RB242-19

IRC: R703.7.3, R703.7.3.1(New), R703.7.3.2(New)

Proposed Change as Submitted

Proponents: Mike Fischer, representing Self (mfischer@kellencompany.com); Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2018 International Residential Code

Revise as follows:

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall comply with Section R703.7.3.1 or Section R703.7.3.2.~~include a water-resistive, vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section R703.4 and intended to drain to the *water-resistive barrier*, is directed between the layers.~~

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

Add new text as follows:

R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water- absorbing layer.

R703.7.3.2 Moist or marine climates. In the moist (A) or marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. In addition to complying with Section R703.7.3.1, a space not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
2. In addition to complying with Section R703.7.3.1 Item 2, a space having a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925, shall be added to the exterior side of the *water-resistive barrier*.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM E2925-17: Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

Reason: The proposal does two things. First, it reorganizes the provisions by deleting an exception (which is really a construction option) and replacing it with subsections that indicate different methods of complying with stucco water-resistive barrier requirements. Second, the proposal properly applies requirements in relation to climate -- something that has been missing in the code and is needed to avoid higher risk of moisture problems in climates that are moist/rainy. The proposal will help resolve problems with stucco performance (e.g., moisture problems over wood-based sheathings) and avoid impacting cost or performance where performance has a long-standing record of good performance (e.g., dry climates such as the southwestern region of the U.S.).

Cost Impact: The code change proposal will increase the cost of construction
The proposal will not increase cost for substrates other than wood-based sheathing. Also, it will not impact cost or change requirements in dry climates where stucco has a long record of successful performance. This also will not impact cost in moist or marine climates where similar actions are already being taken (e.g., a drainage space) to reduce risk of moisture damage.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E2925-17, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB242-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water- absorbing layer, or a designed drainage space.

R703.7.3.2 Moist or marine climates. In the moist (A) or marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than 3/16 inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
2. In addition to complying with Section R703.7.3.1 Item 2, drainage on the exterior side of the water-resistive barrier shall have ~~a space having~~ a drainage efficiency of not less than 90%, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925~~, shall be added to the exterior side of the *water-resistive barrier*~~.

Committee Reason: The modification adds options for water resistive barriers. The proposal provides appropriate water resistive barriers for use with wood based sheathing and exterior plaster.

Assembly Action: **None**

Staff Analysis: The proposals for RB242, RB243, RB244, RB245 and RB246 need to be coordinated.

RB242-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R703.7.3.1 (New)

Proponents:
Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R703.7.3.1 Dry Climates. In dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The *water-resistive barrier* shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a *water-resistive barrier* complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier, shall be directed between the layers.
2. water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type I or II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water- absorbing layer, or a designed drainage space.

Commenter's Reason: This change brings RB242 into compliance/coordinates with RB243 which also passed. The requirement for meeting Type II is too restrictive and prevents the use of successfully performing less expensive alternatives such as fluid applied water control layers and integral water control layers incorporated into sheathing. The key performance requirement is drainage. With drainage as defined or the space as it is defined Type II

materials are not necessary. This modification recognizes that the most important factor relating to addressing the issues with stucco are drainage not the resistance to hydrostatic pressure. In other words drainage is more important than requiring a Type II water resistive barrier. A Type I water resistive barrier with drainage significantly outperforms a Type II water resistive barrier without drainage. ASTM E2556 does not address drainage.
ASTM E2556 requires materials to resist a water column of over 20 inches of water…a hydrostatic pressure greater than 5,000 pascals (an equivalent wind speed of 200 hundred miles per hour). The requirement is disingenuous when it is understood that sheet membranes are tested under ASTM E2556 without fasteners. Nails are required to install such products…as well as other products. Cladding fasteners then penetrate all products. The key is to control the hydrostatic pressure so the holes don't matter.

Requiring a Type II water resistive barrier creates an artificial barrier to entry for products and approaches that have been demonstrated to work. It excludes products such as OSB sheathings with integral water control layers manufactured by Georgia Pacific, Louisiana Pacific and Huber. It excludes many fluid applied water resistive barriers and it adds unnecessary expense to drainage mat and dimple matt drainage approaches where Type I water resistive barriers function well. Requiring Type II water resistive barriers favors mechanically attached sheet good based water resistive barriers despite evidence that they do not function adequately in stucco assemblies without a gap.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This code change decreases costs.
Requiring materials to meet Type II requirements significantly increases costs relative to meeting Type I requirements. This requirement doubles the material cost per square foot of water resistive barriers resulting in costs on the order of hundreds of dollars per typical single family residential home. Therefore, this code change significantly reduces the cost of construction by hundreds of dollars per typical single family residential home.

Public Comment# 1936

Public Comment 2:

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

requests As Modified by Committee

Commenter's Reason: We request this proposal be approved in accordance with the Committee Action at the CAH.
The proponents testified that:

- The structure of this proposal is useful in that the more restrictive provisions are located in the main body of the text instead of placing these provisions in the exception statement.
- The problem to be solved is moisture performance issues with stucco in moist and marine climate zones. The reason for the problem is that dry climate zone installation techniques, currently required by code, are inadequate to reduce risk of moisture damage and do not provide for adequate drainage behind the stucco.
- The proposal breaks the requirements into a dry and moist/marine climate zone solution. There is a prescriptive solution – a 3/16" gap or drainage material and a performance solution which is a drainage efficiency requirement in accordance with ASTM standards.
- The water-resistive barrier requirements are retained as currently prescribed by code, and are specified in accordance with ASTM E2556, Type II, which has been in the code since 2006 and a part of ICC-ES AC-11 requirements beforehand.
- Opposition to the proposal supported the air gap and drainage plane, but also wanted to lower the WRB moisture performance by changing from a Type II down to a Type I. This was the intent of the other stucco proposals RB243/S194. This was not our original intent, as we have no supporting data or long-term performance studies to support this approach, either on a material or an assembly basis. Furthermore, the IBC-S committee ruled against S194 on lowering the WRB requirement, but both committees supported our proposals (RB242/S196) to add the air gap/drainage plane.

RB242 is consistent with S196 which is the stucco proposal recommended for approval by IBC-S committee. For the above reasons and to maintain consistency between the IRC and IBC, we therefore request your support of the committee action for approval of RB242 as modified.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Refer to the cost impact statement in the original RB242 proposal. It is unchanged.

Public Comment# 1737

RB243-19

IRC®: R703.7.3, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Residential Code

Revise as follows:

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

> **Exception:** Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of ~~60-minute Grade D paper~~ a water-resistive barrier complying with ASTM E2556 Type I and is separated from the stucco by an intervening~~, substantially nonwater-absorbing layer or designed drainage~~ foam plastic insulating sheathing layer or by a minimum 3/16 inch (5 mm) space.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E2556/E2556M—10: Standard Specification for Vapor Permeable Flexible Sheet Water-resistive Barriers Intended for Mechanical Attachment

Reason: Objective:

1. Define water resistance as the primary functional requirement of the WRB and remove reference to vapor permeable.
2. Enable a single layer of WRB complying with ASTM E2556 Type I with a drainage space.
3. Define depths drainage space

The existing code language gives insufficient guidance for other approved materials. The added language addresses this issue and provides a specific performance requirement for water resistance and provides consistancy with other sections of the code that relate specfically to water-resistive barriers.

The size of the drainage space needs to be specified. Type 1 is the appropriate water-resistive metric for the specified space. This logic is consistant with the body and intent of the text of Section R703.7.3. The specified space and one layer of Type 1 provides equivalent performance to the two layers of Type 1 specified in the body of R703.7.3.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change gives better guidance for water-resistance.

Staff Analysis: The referenced standard, ASTM E2556/E2556M-10, is currently referenced in other 2018 I-codes.

RB243-19

Public Hearing Results

Committee Action: As Modified

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

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-

minute Grade D paper or a water-resistive barrier complying with ASTM E2556 Type I and is separated from the stucco by an intervening foam plastic insulating sheathing layer or by a minimum 3/16 inch (5 mm) space or a drainage layer having a drainage efficiency of not less than 90 percent as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

Committee Reason: The modification helps coordinate this item with RB242 by adding back in the 60 min grade D paper, to improve drainage efficiency, and indicates that a drainage gap is needed. The choice of a single layer is offered. (Vote: 10-1)

Assembly Action: None

Staff Analysis: The proposals for RB242, RB243, RB244, RB245 and RB246 need to be coordinated.

RB243-19

Individual Consideration Agenda

Public Comment 1:

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

requests Disapprove

Commenter's Reason: RB243 is not consistent with RB242 and S196, both of which were recommended for approval as modified by the IRC-B and IBC-S committees. There are several reasons for disapproving RB243. First, S194 (similar to RB243) was recommended for disapproval by the IBC-S committee. Therefore, disapproving RB243 will better ensure that the IRC and IBC stucco WRB provisions are coordinated.
Second, disapproving RB243 will ensure there are no technical and formatting conflicts with regard to coordinating RB242 and RB243 for the IRC. For example, RB242 is formatted to clarify under what climate conditions additional drainage or gap is required. Conversely, RB243 lacks this formatting which is needed to give direction for where to use a drainage gap (and also where it is not needed). In addition, RB243 creates a technical conflict within the exception by referring to ASTM E2556 Type I and 60-minute Grade D paper which implies they have equivalent water-resistance. They are not equivalent; 60-minute Grade D paper is Type II in accordance with ASTM E2556 and has a greater water-resistance than Type I (e.g., 10-minute Grade D paper). Type II (i.e., 60-minute Grade D paper) has been the accepted minimum requirement since 2006 and in ICC-ES evaluation criteria prior to that time. This should not be changed without substantiating evidence.

In closing, RB242 and S196 provide a more complete, better formatted, coordinated, and technically robust provision for the IRC and IBC, respectively. Disapproving RB243 will ensure that intent is maintained.

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# 1742

RB248-19

IRC®: TABLE R703.8.4(1)

Proposed Change as Submitted

Proponents: Charles Clark Jr, Brick Industry Association, representing Brick Industry Association (cclark@bia.org)

2018 International Residential Code

Revise as follows:

TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER[~~a~~ c]	AIRSPACE[~~e~~ b]	
Wood stud backing with corrugated sheet metal	22 U.S. gage(0.0299 in.) × $^{7}/_{8}$ in. wide	8d common nail [~~b~~ c] ($2^{1}/_{2}$ in. × 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint [d]	8d common nail [~~b~~ c] ($2^{1}/_{2}$ in. × 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum ~~$4^{1}/_{2}$~~ $4^{5}/_{8}$ in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e,f]	8d common nail [c] ($2^{1}/_{2}$ in. x 0.131 in.)	Greater than $4^{5}/_{8}$ in. between backing and veneer	Maximum $6^{5}/_{8}$ in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint [d]	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum nominal 1 in. between sheathing and veneer	Maximum ~~$4^{1}/_{2}$~~ $4^{5}/_{8}$in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e,f]	No. 10 screw extending through the steel framing a minimum of three exposed threads	Greater than $4^{5}/_{8}$ in. between backing and veneer	Maximum $6^{5}/_{8}$ in. between backing and veneer

~~b.~~ a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

~~c.~~ b. An airspace that provides drainage shall be permitted to contain mortar from construction.

~~a.~~ c. In Seismic Design Category D_0, D_1 or D_2, the minimum tie fastener shall be an 8d ring-shank nail (2 ½ in. x 0.131 in.) ~~or a No. 10 screw extending through the steel framing a minimum of three exposed threads~~.

d. Adjustable tie pintle shall include a minimum of 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of 1-1/4 in.

e. Adjustable tie pintle shall include a minimum of 2 pintle legs with a maximum offset of 1-1/4 in. Distance between inside face of brick and end of pintle shall be a maximum of 2 in.

f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum 1/4 in. outside dia., or plate with minimum thickness of 0.074 in. and minimum width of 1-1/4 in.

Reason: This code change proposal allows larger airspaces to be constructed between masonry veneer and backing. Larger airspaces are necessary in order to accommodate thicker continuous insulation which may be needed in colder climate zones.
If adopted, the tie and airspace provisions of the IRC would match those required by the IBC through reference to the anchored masonry veneer provisions of TMS 402 Building Code Requirements for Masonry Structures. As such, they would allow masonry veneer with airspaces up to a maximum of 4-5/8 in. to be constructed using the traditional tie configurations already in the existing IRC table. They would also allow masonry veneer with airspaces greater than 4-5/8 in. up to a maximum of 6-5/8 in. to be constructed using stiffer tie configurations.

This code change proposal also adjusts the existing footnotes in the table (Footnotes a, b and c). For the footnote addressing Seismic Design Category D0, D1 or D2, there is no need to include No. 10 screws as they are already required for all cold-formed steel framing. Footnotes addressing rust-inhibitive coating and construction mortar are moved to more appropriate locations.

Cost Impact: The code change proposal will increase the cost of construction
This code change proposal WILL NOT increase the cost of constructing masonry veneer with an airspace of 4-1/2 in. or smaller as currently allowed by the exsiting code provision. Rather, it allows the construction of masonry veneer with an airspace larger than 4-1/2 in. to a maximum of 6-5/8 in. However, masonry veneer with an airpace greater than 4-5/8 in. will be more expensive than veneer with an airspace of 4-5/8 in. or less because stiffer ties are required to span the larger airspace.

RB248-19

Public Hearing Results

Errata: This proposal includes the following errata

There are three unpublished errata to Table R703.8.4(1). They should read as follows:

In the 1st row, 3rd column - MINIMUM TIE FASTENER ~~a~~ c

In the 5th row, 2nd column - W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint d

In Foot note b - ~~c.~~ b. An airspace that provides drainage shall be permitted to contain mortar from construction

Committee Action: **Disapproved**

Committee Reason: While the committee liked the idea, the proposal was disapproved because the proposal needs fixes between the footnotes and the references in the table. (Vote: 10-1)

Assembly Action: **None**

RB248-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R703.8.4(1)

Proponents:
Charles Clark Jr, representing Brick Industry Association (cclark@bia.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER[e a]	AIRSPACE[b]	
Wood stud backing with corrugated sheet metal	22 U.S. gage(0.0299 in.) × $^{7}/_{8}$ in. wide	8d common nail [c] ($2^{1}/_{2}$ in. × 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia) with hook embedded in mortar joint[d]	8d common nail [c] ($2^{1}/_{2}$ in. × 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum $4^{5}/_{8}$ in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e,f]	8d common nail [c] ($2^{1}/_{2}$ in. x 0.131 in.)	Greater than $4^{5}/_{8}$ in. between backing and veneer	Maximum $6^{5}/_{8}$ in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint[d]	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum nominal 1 in. between sheathing and veneer	Maximum $4^{5}/_{8}$in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint[e,f]	No. 10 screw extending through the steel framing a minimum of three exposed threads	Greater than $4^{5}/_{8}$ in. between backing and veneer	Maximum $6^{5}/_{8}$ in. between backing and veneer

a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

b. An airspace that provides drainage shall be permitted to contain mortar from construction.

c. In Seismic Design Category D0, D_1 or D_2, the minimum tie fastener shall be an 8d ring-shank nail (2 ½ in. x 0.131 in.) .

d. Adjustable tie pintle shall include a minimum of 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of 1-1/4 in.

e. Adjustable tie pintle shall include a minimum of 2 pintle legs with a maximum offset of 1-1/4 in. Distance between inside face of brick and end of pintle shall be a maximum of 2 in.

f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum 1/4 in. outside dia., or plate with minimum thickness of 0.074 in. and minimum width of 1-1/4 in.

Commenter's Reason: As indicated by the Committee and as reflected in their Committee Reason statement, they were in favor of the proposal but fixes were needed to the footnotes and references. This Public Comment along with the Errata published with the Public Hearing Results fixes the errors in the footnotes and references that were created by the cdpACCESS software. The specific modification made by this Public Comment indicates that footnote “a” applies to the column heading “MINIMUM TIE FASTENER” thus requiring all fasteners to have a rust-inhibitive coating or to be made from a material not susceptible to corrosion.
The overall effect of this change will be to allow wider airspaces of up to 6-5/8 in. behind anchored masonry veneer to accommodate thicker insulation. This is possible by requiring the use of stiffer veneer ties across airspaces that are wider than 4-5/8 in. Anchored masonry veneer with airspaces up to 4-5/8 in. wide will require the same veneer tie size and spacing as required in the current IRC provisions and will not be impacted by this change.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the cost impact submitted with the original proposal, this code change proposal WILL NOT increase the cost of constructing masonry veneer with an airspace of 4-1/2 in. or smaller as currently allowed by the existing code provision. Rather, it allows the construction of masonry veneer with an airspace larger than 4-1/2 in. to a maximum of 6-5/8 in. However, masonry veneer with an airspace greater than 4-5/8 in. will be more expensive than veneer with an airspace of 4-5/8 in. or less because stiffer ties are required to span the larger airspace.

Public Comment# 1808

RB255-19

IRC®: R802.1.5

Proposed Change as Submitted

Proponents: Marcelo Hirschler, GBH International, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) 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 ~~and does not show evidence of significant progressive combustion where the test is~~ . In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes ~~. In addition,~~ and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the extended 30-minute test.

Reason: This proposal addresses the incorrect double requirement for testing to both flame front progress and no significant progressive combustion in the extended ASTM E84 test.
This issue has been under discussion for many years at the ICC codes, as well as at ASTM and at NFPA, but can now be resolved in the IRC code. The ASTM E5 committee, responsible for ASTM E84, has now, for the first time, accepted incorporating requirements for conducting a 30 minute test. Until this change ASTM E84 did not contain any information other than that it is a 10 minute test. Consequently, until this change ASTM E84 did not provide any details on how to assess either "no evidence of significant progressive combustion" or "the flame front shall not progress more than 101/2 feet (3200 mm) beyond the centerline of the burners". The information for how to determine both of those characteristics is contained in ASTM E2768. The committee agreed that the next edition of ASTM E84 will state that a 30 minute test is to be conducted per ASTM E2768. In turn, ASTM E2768 explains that "no significant progressive combustion" is evidenced by lack of flame front progress beyond 10 1/2 feet. In fact ASTM E2768 states: "The flame front shall not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the 30 min test period. This is considered evidence of no significant progressive combustion in this test method." This IBC proposal incorporates the requirements from the ASTM E84 test into the IBC and ensures that the code does not require a duplicate (and confusing) measurement.

It is likely that information will be presented stating that "no significant progressive combustion" has been in the code since the legacy codes and that the flame front progress requirement was added later. That is exactly the reason that ASTM E2768 was developed to ensure that everyone understands what is to be measured, and that is what the testing laboratories have been doing for many years now.

This change appears to alter requirements but in fact simply recognizes what the ASTM E84 standard states and what the labs are doing (and have been doing for years) and, therefore, is really clarification.

The ASTM E05 committee agreed on actions at the December 2018 meeting so that the language in ASTM E84 reads:

1. Scope

1.1 This fire-test–response standard for the comparative surface burning behavior of building materials is applicable to exposed surfaces such as walls and ceilings. The test is conducted with the specimen in the ceiling position with the surface to be evaluated exposed face down to the ignition source. The material, product, or assembly shall be capable of being mounted in the test position during the test. Thus, the specimen shall either be self-supporting by its own structural quality, held in place by added supports along the test surface,or secured from the back side.

1.2 Test Method E84 is a 10-minute fire-test response method. The following standards address testing of materials in accordance with test methods that are applications or variations of the test method or apparatus used for Test Method E84:

1.2.1 Materials required by the user to meet an extended 30-min duration tunnel test shall be tested per Test Method E2768.

1.2.2 Wires and cables for use in air-handling spaces shall be tested per NFPA 262.

1.2.3 Pneumatic tubing for control systems shall be tested per UL 1820.

1.2.4 Combustible sprinkler piping shall be tested per UL 1887.

1.2.5 Optical fiber and communications raceways for use in air handling spaces shall be tested per UL 2024.

1.3 The purpose of this test method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke developed index are reported. However, there is not necessarily a relationship between these two measurements.

1.4 The use of supporting materials on the underside of the test specimen has the ability to lower the flame spread index from those which might be *obtained if the specimen could be tested without such support. These test results do not necessarily relate to indices obtained by testing materials without such support.*

1.5 Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed,results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of the standard.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This simply recognizes what the fire test labs have ben doing for many years. When they conduct the "extended ASTM E84 test" they assess two criteria: a flame spread index of 25 and a flame front that does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners.

RB255-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal for several reasons. The proposal has a lower safety standard. There was a debate on the technical justification in testing. The standard in the reason statement, ASTM E05, is not referenced in the ICC. (Vote: 11-0)

Assembly Action: **None**

RB255-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R802.1.5

Proponents:
Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) 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 .In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the ~~extended 30-minute~~ test.

Commenter's Reason: Wording approved by IBC S committee in S166. This is also consistent with what was approved in NFPA 703.

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 simply recognizes what the fire test labs have been doing for many years. When they conduct the "extended ASTM E84 test" they assess two criteria: a flame spread index of 25 and a flame front that does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners.

Public Comment# 1182

Public Comment 2:

IRC®: R802.1.5

Proponents:
David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) 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 .In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minutes and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during th~~e extended 30-minute~~ test.

Commenter's Reason: This public comment will bring the language of IRC Section R802.1.5 into consistency with the language of IBC Section 2303.2, as approved under S166-19 at the Committee Action Hearings. It cleans up and simplifies the language of R802.1.5, while making it more consistent with the referenced test methods.

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 change in the cost of construction because the public comment simply will bring the language of IRC Section R802.1.5 into consistency with the language of IBC Section 2303.2, as approved under S166-19 at the Committee Action Hearings

Public Comment# 1698

Public Comment 3:

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests Disapprove

Commenter's Reason: We feel this lessons the life safety aspect of the code and should be maintained. The committee agreed unanimously.

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# 1676

RB256-19

IRC®: R802.1.5.2

Proposed Change as Submitted

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5.2 Other means during manufacture. For wood products ~~produced~~ 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, coatings, stains or other surface treatments is not an approved method of protection as required in this section.

Reason: This proposal corrects the language of the section by making it identical to the language of the corresponding section of the IBC. The proposal makes two changes:
1. It incorporates the words "impregnated with chemicals" into the first sentence, which makes it consistent with the code section above that says that the pressure treatment process must provide impregnation with chemicals.

2. It adds a sentence pointing out that coatings are not permitted as a way of generating fire retardant treated wood.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is clarification, consistent with the IBC and with the section above.

RB256-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal for several reasons. The concern was with the new last sentence. This issue is better addressed in commentary. Other products that are developed in the future should be permitted. This statement could be read to over ride evaluation service reports. The addition of "impregnated with chemicals" would better language that is consistent with other areas of the code. (Vote: 6-5)

Assembly Action: **None**

RB256-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R802.1.5.2

Proponents:
Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R802.1.5.2 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~~ Wood products treated with paints, coatings, stains or other surface treatments shall not be considered fire-retardant treated wood. ~~is not an approved method of protection as required in this section~~.

Commenter's Reason: This public comment revises the existing code section by adding a sentence clarifying that surface treatments (including paints and coatings) do not represent a way of generating fire-retardant treated wood. This is consistent with the original proposal but revises the sentence to react to the committee statement that the original sentence appears to be more information than a requirement. The language in the original proposal was the same as the language in IBC now. It is essential to point out that paints, coatings, stains or other surface treatments are not means to "impregnate" a wood product as they are surface treatments.
The committee stated that "Any Other products that are developed in the future should be permitted." Neither the original language nor the revised language for the existing code section prevents any product, by whatever means it is manufactured, from being considered "fire retardant treated wood" as long as it complies with all the requirements in the charging paragraph, the critical one being that the new product must be "impregnated with chemicals" and "surface treatments" are, by definition, different from "impregnation".

The committee also stated that "This statement could be read to over ride evaluation service reports." There should be no evaluation reports that identify coated products as "impregnated" products and, therefore, this sentence is basically just clarification.

Finally, the committee stated that "The addition of "impregnated with chemicals" would be language that is consistent with other areas of the code. However, the charging section already states that these products must be impregnated with chemicals, and this is, therefore, consistent with the remainder of the code.

In summary, the public comment introduces a new sentence that clarifies, in proper mandatory language, that surface treatments, such as coatings, shall not be used to create fire-retardant treated wood, and the reason is that surface treatments do not "impregnate" the wood.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The added sentence is clarification only, consistent with the charging paragraph, because this section is often misunderstood.

Public Comment# 1413

Public Comment 2:

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com); Joseph Holland, representing Hoover Treated Wood Products (jholland@frtw.com)

requests As Submitted

Commenter's Reason: This change would adopt language already in the IBC and thus make it more consistent.

Code requirements were established for only products produced using a pressure process. Testing performed using E-84 tunnel shows that coated products when tested with an 1/8" gap the length of the tunnel will not pass the test while pressure impregnated products do. The 1/8" gap is more representative of how the product will be used in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
It is making the code more consistent.

Public Comment# 1677

Public Comment 3:

Proponents:
David Tyree, representing American Wood Council (dtyree@awc.org)

requests Disapprove

Commenter's Reason: The AWC supports the committee action for DISAPPROVAL. At the Committee Action Hearings, the Committee had concerns that the proposed new sentence at the end of R802.1.5.2 could be interpreted as overriding evaluation service reports. AWC agrees with the Committee recommendation for disapproval. Surface treatments such as paints, coatings and stains are more appropriately addressed through Section R104.11, which deals with alternative materials, design and methods of construction and equipment.

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# 1674

RB257-19

IRC®: R802.1.5.2

Proposed Change as Submitted

Proponents: Manny Muniz, representing Representing self (Mannymuniz.mm@gmail.com)

2018 International Residential Code

Revise as follows:

R802.1.5.2 Other means during manufacture. For wood products ~~produced~~ 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 by this section.

Reason: The proposed code language has already been approved in the IBC and appears in the 2018 International Building Code, Section 2303.2.2. Clarification is made that regardless of the other means used during manufacture, fire-retardant-treated wood must be impregnated with chemicals per the definition of fire-retardant-treated wood in Chapter 2. During the IBC committee hearings, the State Fire Marshal of California, a committee member, identified this code change as being a necessary clarification as California had experienced numerous problems with coated wood products pretending to be fire-retardant-treated wood. The language in the last sentence was derived from the California codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change simply clarifies what is not an approve method of protection as required by this section.

RB257-19

Public Hearing Results

Errata: This proposal includes unpublished errata
The cost impact statement should read as follows:

Cost impact: The code change proposal will not increase or decrease the cost of construction. The code change simply clarifies what is not an approved method of protection as required by this section.

Committee Action: **Disapproved**

Committee Reason: This proposal was disapproved for consistency with the committee action on RB257. (Vote: 7-4)

Assembly Action: **None**

RB257-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Christopher Athari, representing Hoover Treated Wood Products (cathari@frtw.com)

requests As Submitted

Commenter's Reason: This change would adopt language already in the IBC and thus make it more consistent.

Code requirements were established for only products produced using a pressure process. Testing performed using E-84 tunnel shows that coated products when tested with an 1/8" gap the length of the tunnel will not pass the test while pressure impregnated products do. The 1/8" gap is more representative of how the product will be used in the field.

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

Public Comment# 1679

Public Comment 2:

Proponents:
Manny Muniz, representing Representing self (mannymuniz.mm@gmail.com)

requests As Submitted

Commenter's Reason: The proposed code language has already been vetted in the IBC and now appears in the 2018 International Building Code, Section 2303.2.2. Clarification is made that regardless of the other means used during manufacture, fire-retardant-treated wood must be impregnated with chemicals per the definition of fire-retardant-treated wood in Chapter 2. During the 2018 IBC committee hearings, the State Fire Marshal of California, a committee member, identified this code change as being a necessary clarification as California had experienced numerous problems with coated wood products pretending to be fire-retardant-treated wood. The language in the last sentence was derived from the California codes.
There is considerable confusion regarding the use of paints, coatings, stains or other surface treatments for fire-protection purposes on the exterior of a structure. Such a product is not regulated by the International Building Code or the International Fire Code and there are no nationally recognized standards for such products.

NFPA 703 (*"Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials")* Chapter 5 Fire-Retardant Coatings for Building Materials only applies to fire-retardant paints and other surface coatings applied to building materials **used for interior finish** to reduce flame spread or smoke development or both (5.1). NFPA 703 is referenced in Section 803.4 of the International Fire Code.

In the NIST research report **"Effect of Fire-Retardant Coatings and Weathering on the Flammability of Wood-Based Materials in WUI Communities",** the conclusion was that commercial FR coatings are only good for a few weeks and that FR coatings + top-coating are only good for a few months.

The committee reason for disapproval is puzzling. *"There has been no history of failure of tests for fire retardant treated wood. This could be an undue burden on manufacturers."* What relevance is there that "*There has been no history of failure of tests for fire retardant treated wood"* given the fact that the definition of fire-retardant-treated wood in Chapter 2 requires that it be impregnated with chemicals. How could this be an undue burden on manufacturers of fire-retardant-treated wood?

Chapter 2, Definitions

Treated Wood

"Fire-retardant-treated wood. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire."

Bibliography: The 2018 International Building Code; the 2016 California Building Code; the 2019 California Building Code; and the NIST Report - Effect of Fire-Retardant Coatings and Weathering on the Flammability of Wood-Based Materials in WUI Communities
https://www.nist.gov/sites/default/files/documents/2019/06/03/laura_dubrulle_bcc_2019_final.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The amendment to the first sentence is derived from the Chapter two definition for fire-retardant-treated wood and is intended for clarity. The addition of the last sentence simply clarifies what is not an approved method of protection as required by this section and correlates with the same clarification already established in IBC 2303.2.2. As such, the cost of construction will not increase or decrease.

Public Comment# 1879

RB258-19

IRC: R802.1.5.3, 802.1.5.3.1 (New)

<u>*Proposed Change as Submitted*</u>

Proponents: Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

2018 International Residential Code

Revise as follows:

R802.1.5.3 Testing. For ~~wood products produced by other means during manufacture, other than a pressure process, all sides~~ <u>fire retardant treated wood products the front and back faces</u> of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5. ~~Testing of only the front and back faces of wood structural panels shall be permitted.~~

Add new text as follows:

<u>**R802.1.5.3.1** **Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).</u>

Reason: Note that the sections above require that fire retardant treated wood be "impregnated with chemicals" and provide permanent protection. That requirement applies to all FRTW products, whether produced by a pressure process or produced by other means during manufacture. IBC Section 2303.2.2 (and the proposed revision to R802.1.5.2, for consistency) is also explicit in stating that the use of paints or coatings is not an approved method to comply with this section. This proposal thus eliminates the requirement to test a particular type of fire retardant treated wood on "all sides", since the testing is never actually conducted on all sides (as pointed out often by multiple testifiers in previous code cycles) because all sides really means front and back (you literally cannot test the edges in the ASTM E84 other than by putting multiple edge pieces into the tunnel to make up the 24 feet by 2 feet specimen). In order to test "all sides" of a lumber product it would be necessary to fasten 864 small pieces together to make one specimen, which is not realistic.
The proposed new subsection will add fire safety because it recognizes an issue that was highlighted in the previous code cycle, and was also brought up in committee ASTM E05 and at the IWUIC: wood structural panels are typically installed in the field following industry practice. Industry recommendations for wood structural panels require a gap to accommodate dimensional changes caused by swelling due to changing moisture conditions. Therefore, installation in the field requires cutting and ripping of the panels and this results in the creation of "non-factory edges". Therefore, it is important to test wood structural panels with a rip or gap to ensure that the required fire test results from the charging paragraph are achieved when the interior of the panel is exposed.

Note that the IWUIC requires such a rip or gap for ignition resistant structural panels, and it sends FRTW products to IBC section 2303.2, which is equivalent to section R802.1.5.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will add fire safety and will require more testing for wood structural panels. The proposal will also require more testing for other FRTW products manufactured by a pressure process but apparently less testing for FRTW products that are manufactured by other means, except that typically just the front and back faces are tested anyway.

RB258-19

<u>*Public Hearing Results*</u>

Committee Action: **Disapproved**

Committee Reason: The committee disapproved this proposal for several reasons. There has been no history of failure of tests for fire retardant treated wood. This could be an undue burden on manufacturers. (Vote: 11-0)

Assembly Action: **None**

RB258-19

<u>*Individual Consideration Agenda*</u>

Public Comment 1:

IRC®: R802.1.5.3, R802.1.5.3.1 (New)

Proponents:
Marcelo Hirschler, representing GBH International (mmh@gbhint.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R802.1.5.3 Testing.** For fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5.~~

~~**R802.1.5.3.1 Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).~~

Commenter's Reason: This public comment recommends deleting the entire section, including the added revised wording. This would make it consistent with the action taken by the IBC S committee and eliminates both the requirement for excessive unnecessary testing (including the discrimination based on the means of manufacture) and the proposed new added requirement to test panels with a rip or gap. ASTM is working on considering testing for panels and the inclusion in codes is premature at this point.
Note that the original proposal increased testing for pressure-treated FRTW products and decreased testing for other FRTW products, while the PC lower everyone's testing burden, reducing costs and creating a level playing field for all FRTW products.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The public comment will decrease the amount of unnecessary fire testing of one particular type of fire-retardant treated wood as compared to other types of fire-retardant treated wood, when the only difference is the manufacturing process. The public comment recognizes that the added testing required by this section has no effect on fire safety.

Public Comment# 1187

Public Comment 2:

IRC®: R802.1.5.3, R802.1.5.3.1 (New)

Proponents:
David Tyree, representing American Wood Council (dtyree@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

~~**R802.1.5.3 Testing.** For fire retardant treated wood products the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5.~~

~~**R802.1.5.3.1 Fire testing of wood structural panels.** Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).~~

Commenter's Reason: This public comment will bring the language of IRC Section R802.1.5.3 into consistency with the language of IBC Section 2303.2.3, as approved under S167-19 at the Committee Action Hearings. Section R802.1.5 already addresses testing and performance requirements for FRTW produced either by a pressure process or by other means during manufacture, so the testing provisions of Section R802.1.5.3 are redundant and unnecessary. Furthermore, the fact that Section R802.1.5.3 is applicable only to FRTW produced by other means during manufacture creates a potential for double-standards when compared to the requirements for FRTW produced by a pressure process. Deletion of R802.1.5.3 will remove these redundant provisions and help to ensure a 'level playing field' between FRTW product types. With regards to the proposed new Section R802.1.5.3.1, we agree with the Committee in their assessment that the proposed provision requiring a 1/8" longitudinal gap 'could be an undue burden on manufacturers.' Specific provisions regarding testing should be addressed in the applicable consensus-based test standard, rather than 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
This public comment will bring the language of IRC Section R802.1.5.3 into consistency with the language of IBC Section 2303.2.3, as approved under S167-19 at the Committee Action Hearings so no increase or decrease of construction costs.

RB261-19

IRC: R802.5.2, TABLE R802.5.2, R802.5.2.1, R802.5.2.2, R802.5.2.3

Proposed Change as Submitted

Proponents: Randy Shackelford, P.E., Simpson Strong-Tie Co., representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

2018 International Residential Code

Add new text as follows:

R802.5.2 Ceiling joist and rafter connections. Ceiling joists, rafter ties and ridge beams shall be in accordance with Sections R802.5.2.1 and R802.5.2.2.

Revise as follows:

~~R802.5.2~~ R802.5.2.1 Ceiling ~~joist and rafter connections.~~ joists parallel to rafters. Where ceiling joists run parallel to rafters and are located at the top wall plate, they shall be connected to rafters ~~at~~ and the top wall plate in accordance with Table ~~R802.5.2~~ R802.5.2.1. Where ceiling joists are not connected to the rafters at the top wall plate, they shall be installed in the bottom third of the rafter height in accordance with Figure R802.4.5 and Table ~~R802.5.2~~ R802.5.2.1. Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice.~~as a beam.Where ceiling joists do not run parallel to rafters, the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each rafter shall be tied across the structure with a rafter tie or a 2-inch by 4-inch (51 mm × 102 mm) kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2.~~

TABLE ~~R802.5.2~~ R802.5.2.1
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS[a, b, c, d, e, g]

Portions of table not shown remain unchanged.

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)															
		20[f]				30				50				70			
		Roof span (feet)															
		12	20	28	36	12	20	28	36	12	20	28	36	12	20	28	36
		Required number of 16d common nails[a, b] per heel joint splices[c, d, e]															

Add new text as follows:

R802.5.2.2 Ceiling joists not parallel to rafters or not provided. Where ceiling joists do not run parallel to rafters, the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each rafter shall be tied across the structure with a rafter tie not less than 2 inches by 4 inches (51 mm × 102 mm) fastened to rafters in accordance with Table R802.2.5.1 and with joints in accordance with Section R802.5.3. Where ceiling joists or rafter ties are not provided, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice.

Revise as follows:

~~**R802.5.2.1**~~ **R802.5.3 Ceiling joists lapped.** Ends of ceiling joists shall be lapped not less than 3 inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with Table R802.5.2 and butted joists shall be tied together with a connection of equivalent capacity in a manner to resist such thrust. Joists that do not resist thrust shall be permitted to be nailed in accordance with Table R602.3(1). ~~Wood structural panel roof sheathing, in accordance with Table R503.2.1.1(1), shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.~~

Delete without substitution:

~~**R802.5.2.2 Rafter ties.** Wood rafter ties shall be not less than 2 inches by 4 inches (51 mm × 102 mm) installed in accordance with Table R802.5.2 at each rafter. Other approved rafter tie methods shall be permitted.~~

Revise as follows:

~~**R802.5.2.3**~~ **R802.5.4** ~~**Blocking.**~~ **Lumber.** ~~Blocking~~ Lumber used to transfer loads shall be not less than utility grade lumber.

Reason: The purpose of this code change is to clarify the requirements for connections of rafters and ceiling joists. This seciton is the most important section in establishing the concept of the continuous tie across the lower portion of the rafters, using either ceiling joists or rafter ties, which will prevent the rafters from sliding off the walls or pushing the walls out when the rafters are loaded, which is referred to as rafter thrust. The concept is that the ceiling joists have to be installed in the lower portion of the attic, and fastened in a specific manner as required in Table R802.5.2. However, sometimes the ceiling joists are installed higher in the attic where they are ineffective as a tie, sometimes the ceiling joists are installed perpendicular to the rafters, and sometimes there may not be any ceiling joists at all, such as in a cathedral ceiling.

So the first revision is to break out these possibilities into two separate sections to clarify what needs to happen in each case to ensure the rafters do not slide off the walls or push them outward.

In each case, either a tie can be provided, or a "wall or ridge beam designed in accordance with accepted engineering practice" can be provided. This language is close to what was required in this section prior to the 2018 edition.

In new R802.5.2.2, the requirements for rafter ties are moved back into this section, and the description of the rafter tie is provided. Since it is in this section now, the subsequent section on Rafter Ties can be deleted. The language about the kicker connected to the ceiling diaphragm is deleted because I don't know what a kicker really is in regard to ceiling joists, and because a prescriptive requirement is not provided. Any alternate method could be accepted if proven equivalent.

In new R802.5.3, Ceiling Joists Lapped, the last sentence talking about wood structural panel roof sheathing is deleted because this is out of place. The exact same wording is repeated in Section R803.2.3, which is the appropriate location.

In the last section, the term "blocking" was replaced by "lumber". It does not appear that the term "blocking" is used anywhere in this section, but it is possible that scabs of wood could be used to transfer tension loads across butt joints in ceiling joists or rafter ties, so it is proposed to be left in this way.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no intent to cause any change in requirements, just a clarification.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal is generally a good idea, but it would inappropriately remove the option for kickers in attics. Section R802.5.3 clarifies butted joist connections, but it is not clear how to determine equivalent capacity. (Vote: 10-1)

Assembly Action: **None**

RB261-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R802.3, R802.5, R802.5.2, R802.5.2.1, R802.5.2.2, R802.5.2.3

Proponents:
Randy Shackelford, representing Simpson Strong-Tie Co. (rshackelford@strongtie.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Residential Code

R802.3 Ridge. A ridge board used to connect opposing rafters shall be not less than 1 inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the ~~a~~ ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice ~~shall be provided~~ and supported on each end by a wall or column ~~girder~~.

R802.5 Ceiling joists. Ceiling joists shall be continuous across the structure or securely joined where they meet over interior partitions in accordance with ~~Table R802.5.2~~ Section R802.5.2.1. Ceiling joists shall be fastened to the top plate in accordance with Table R602.3(1).

R802.5.2 Ceiling joist and rafter connections. Where ceiling joists run parallel to rafters, and they are located ~~they shall be connected to rafters at the top wall plate in accordance with Table R802.5.2. Where ceiling joists are not connected to the rafters at the top wall plate, they shall be installed~~ in the bottom third of the rafter height , they shall be installed in accordance with Figure R802.4.5 and fastened to rafters in accordance with Table R802.5.2. Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be designed as a beam in accordance with R802.3. Where ceiling joists do not run parallel to rafters, ~~the ceiling joists shall be connected to top plates in accordance with Table R602.3(1). Each~~ rafter s shall be tied across the structure with a rafter tie in accordance with R802.5.2.2, or the ridge shall be designed as a beam in accordance with R802.3. ~~or a 2-inch by 4-inch (51 mm × 102 mm) kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2.~~

R802.5.2.1 Ceiling joists lapped. Ends of ceiling joists shall be lapped not less than 3 inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide the continuous tie across the building ~~resistance to rafter thrust~~, lapped joists shall be nailed together in accordance with Table R802.5.2 and butted joists shall be tied together with a connection of equivalent capacity ~~in a manner to resist such thrust~~. Laps in joists ~~Joists~~ that do not ~~resist thrust~~ provide the continuous tie across the building shall be permitted to be nailed in accordance with Table R602.3(1). ~~Wood structural panel roof sheathing, in accordance with Table R503.2.1.1(1), shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.~~

R802.5.2.2 Rafter ties. Wood rafter ties shall be not less than 2 inches by 4 inches (51 mm × 102 mm) installed in accordance with Table R802.5.2 at ~~each rafter~~ a maximum of 24" o.c. Other approved rafter tie methods shall be permitted.

R802.5.2.3 Blocking. Blocking shall be not less than utility grade lumber.

Commenter's Reason: The purpose of this code change is to clarify the requirements for connections of rafters and ceiling joists and specify when ridge beams are required. This section describes how to construct a rafter/ceiling joist system so that the rafters do not slide down under loads and push out the exterior bearing walls, which is called rafter thrust. The concept is that the rafters and ceiling joist form a triangle, which is a stable shape that will not change its shape as long as the ends of the three members are connected together. When the lower ends of the rafters are not tied back to resist thrust, the only way to prevent thrust is to support them at the peak by a ridge beam.

The original proposal added new sections and deleted existing sections. This revised proposal keeps the existing sections and just makes changes within them.

R802.3: This section on ridges is revised to bring language from older versions of the IRC about "ridge beam designed in accordance with engineering practice" in the current IRC. Also since the ridge is supporting half the weight of the rafters now, it would have to be supported on each end. It seems like a ridge beam is more likely to be supported by a column than a girder.

R802.5: Ceiling joists need their laps to be in accordance with Section R802.5.2.1, not Table R802.5.2. Where joists provide the continuous tie, then yes the laps do need to be fastened together per Table R802.5.2. But if the joists are not providing the tie, the laps can be fastened per Table R602.3(1). Also moved the requirement for fastening the ceiling joists to the top plate to this section, since that is the same regardless of which direction the ceiling joists run.

R802.5.2: There are really four cases that need to be considered: 1. Ceiling joists parallel to rafters and located at the top plate; 2. Ceiling joists parallel to rafters and located in the bottom third of the roof height; 3. Ceiling joists parallel to rafters and NOT located in the bottom third of the roof height; and 4. Ceiling joists perpendicular to rafters. This proposal keeps these all in one section, but combines the first two since the requirements are the same for both cases. Where the ceiling joists are parallel to the rafters but installed in the upper two-thirds of the roof, it is assumed that there would not be a rafter tie across the lower portion of the rafters, because it would be visible below the ceiling, so the only option given is a ridge beam. Where the joists run perpendicular to the rafters, either a rafter tie can be provided above the joists, or a ridge beam could be provided. The portion of the last sentence referring to a “2” by 4” kicker connected to the ceiling diaphragm with nails equivalent in capacity to Table R802.5.2” is deleted for several reasons. This is not a prescriptive requirement and there is no assurance that the conventional ceiling diaphragm will have the strength to resist these forces. Also I believe there was some thought by members of the IRC-Building Committee that this was an effort to prohibit rafter braces and purlins. That is not the case. Rafter braces and purlins are covered in Section R802.4.5 and would still be permitted if this code change were approved. Further, removing this sentence in R802.5.2 can be seen as removing a conflict with the purlin/brace requirements of Section R802.4.5, since that section requires that braces be supported by bearing walls, not just a ceiling. Also note that footnote d of Table R802.5.2 allows a reduction in the ceiling joist to rafter connections if braces are provided, but does not eliminate the need for these connections overall.

R802.5.2.1: This clarifies the two cases where the ceiling joists are or are not providing the continuous tie across the building and specifies which table to use for fastening the lap splices for each case. Also, the last sentence is deleted since this does not belong here, and is repeated in Section R803.2.3.

R802.5.2.2: Spacing of rafter ties is clarified. Since Table R802.5.2 only gives fastening for rafter spacing of 12, 16, and 24" on center, the spacing of the rafter ties has to be a maximum of 24" o.c. But if rafters were spaced at 12" o.c., the ties would not have to be installed at every rafter, just at a maximum of 24" o.c.

R802.5.2.3: The original proposal revised this section to apply to "lumber used to transfer loads" rather than blocking. There was some concern from the wood industry that utility grade lumber might not be adequate to transfer loads. So it is proposed to make no changes to this section in the Public Comment.

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 is meant to be editorial clarification only. There is no intent to change the requirements.

Public Comment# 2107

RB262-19

IRC®: TABLE R802.5.2

Proposed Change as Submitted

Proponents: Dennis Richardson, American Wood Council, representing American Wood Council (drichardson@awc.org)

2018 International Residential Code

Delete and substitute as follows:

TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS[a, b, c, d, e, g]

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)															
		20[f]				30				50				70			
		Roof span (feet)															
		12	20	28	36	12	20	28	36	12	20	28	36	12	20	28	36
		Required number of 16d common nails[a, b] per heel joint splices[c, d, e]															
3:12	12	4	6	8	10	4	6	8	11	5	8	12	15	6	11	15	20
	16	5	8	10	13	5	8	11	14	6	11	15	20	8	14	20	26
	24	7	11	15	19	7	11	16	21	9	16	23	30	12	21	30	39
4:12	12	3	5	6	8	3	5	6	8	4	6	9	11	5	8	12	15
	16	4	6	8	10	4	6	8	11	5	8	12	15	6	11	15	20
	24	5	8	12	15	5	9	12	16	7	12	17	22	9	16	23	29
5:12	12	3	4	5	6	3	4	5	7	3	5	7	9	4	7	9	12
	16	3	5	6	8	3	5	7	9	4	7	9	12	5	9	12	16
	24	4	7	9	12	4	7	10	13	6	10	14	18	7	13	18	23
7:12	12	3	4	4	5	3	3	4	5	3	4	5	7	3	5	7	9
	16	3	4	5	6	3	4	5	6	3	5	7	9	4	6	9	11
	24	3	5	7	9	3	5	7	9	4	7	10	13	5	9	13	17
9:12	12	3	3	4	4	3	3	3	4	3	3	4	5	3	4	5	7
	16	3	4	4	5	3	3	4	5	3	4	5	7	3	5	7	9
	24	3	4	6	7	3	4	6	7	3	6	8	10	4	7	10	13
12:12	12	3	3	3	3	3	3	3	3	3	3	3	4	3	3	4	5
	16	3	3	4	4	3	3	3	4	3	3	4	5	3	4	5	7
	24	3	4	4	5	3	3	4	6	3	4	6	8	3	6	8	10

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a.40d box nails shall be permitted to be substituted for 16d common nails.
b.Nailing requirements shall be permitted to be reduced 25 percent if nails are clinched.
c.Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
d.Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.
e.Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
f.Applies to roof live load of 20 psf or less.
g.Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS [g]

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		20[e]			30			50			70		
		Roof span (feet)											
		12	24	36	12	24	36	12	24	36	12	24	36
		Required number of 16d common nails per heel joint splice[a,b,c,d,f]											
3:12	12	3	5	8	3	6	9	5	9	13	6	12	17
	16	4	7	10	4	8	12	6	12	17	8	15	23
	19.2	4	8	12	5	10	14	7	14	21	9	18	27
	24	5	10	15	6	12	18	9	17	26	12	23	34
4:12	12	3	4	6	3	5	7	4	7	10	5	9	13
	16	3	5	8	3	6	9	5	9	13	6	12	17
	19.2	3	6	9	4	7	11	6	11	16	7	14	21
	24	4	8	11	5	9	13	7	13	19	9	17	26
5:12	12	3	3	5	3	4	6	3	6	8	4	7	11
	16	3	4	6	3	5	7	4	7	11	5	9	14
	19.2	3	5	7	3	6	9	5	9	13	6	11	17
	24	3	6	9	4	7	11	6	11	16	7	14	21
7:12	12	3	3	4	3	3	4	3	4	6	3	5	8
	16	3	3	5	3	4	5	3	5	8	4	7	10
	19.2	3	4	5	3	4	6	3	6	9	4	8	12
	24	3	5	7	3	5	8	4	8	11	5	10	15
9:12	12	3	3	3	3	3	3	3	3	5	3	4	6
	16	3	3	4	3	3	4	3	4	6	3	5	8
	19.2	3	3	4	3	4	5	3	5	7	3	6	9
	24	3	4	5	3	4	6	3	6	9	4	8	12
12:12	12	3	3	3	3	3	3	3	3	4	3	3	5
	16	3	3	3	3	3	3	3	3	5	3	4	6
	19.2	3	3	3	3	3	4	3	4	6	3	5	7
	24	3	3	4	3	3	5	3	5	7	3	6	9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. 10d common (3” × 0.148”) nails shall be permitted to be substituted for 16d common (3-1/2”x 0.162”) nails where the required number of nails is taken as 1.2 times the required number of 16d common nails.

b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Applies to roof live load of 20 psf or less.

f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Reason: Replace Table R802.5.2 to be consistent with calculation basis of 2018 Wood Frame Construction Manual (WFCM) heel joint nailing requirements based on the 2018 National Design Specification for Wood Construction (NDS) provisions for nailed connections. The reduced number of 16d common nails required in rafter tie connections, by approximately 15%, are due to changes in penetration factor and load duration assumptions from those used to develop the existing table. The existing table used a 0.77 penetration factor (based on 1991 and 1997 NDS) for 16d common nails with less than 12d penetration in the main member and a load duration factor of 1.25 for all tabulated cells. The proposed revised nailing requirements are based on use of a 1.15 load duration factor for snow cases, 1.25 load duration factor for roof live load cases, and an effective penetration factor equal to 1.0 per 2001 NDS and later editions when nail lateral value calculations are based on the actual penetration in the wood member. The ratio of nail design values for snow cases originally used to develop nailing requirements to the current nail design values for snow cases is (Z x 0.77 x 1.25)/(Z x 1.0 x 1.15) = 0.84 and explains the reduced number of nails required by this proposal. Due to revised nail design provisions in the NDS, the benefit of a longer nail that is clinched is no longer recognized for this application and existing footnote b is removed. A 10d common nail option is added in new footnote “a.” based on NDS lateral nail calculations. The table heading clarifies the 10psf dead load basis of the tabulated nailing requirements.

Bibliography: 1) 2018 Wood Frame Construction Manual (WFCM) for One- and Two-Family Dwellings. American Wood Council, Leesburg, VA. 2018. https://awc.org/pdf/codes-standards/publications/wfcm/AWC-WFCM2018-ViewOnly-1711.pdf
2) 2018 National Design Specification (NDS) for Wood Construction. American Wood Council, Leesburg, VA. 2018. https://awc.org/pdf/codes-standards/publications/nds/AWC-NDS2018-ViewOnly-171117.pdf

Cost Impact: The code change proposal will decrease the cost of construction
This code change utilizes fewer nails from the WFCM at less cost.

RB262-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The committee approved this proposal because it is coordinated with the 2018 Wood Frame Construction Manual and the National Design Specifications for Wood Construction. The proposal also added center spacing for joist heels. (Vote: 10-0)

Assembly Action: **None**

RB262-19

Individual Consideration Agenda

Public Comment 1:

IRC®: TABLE R802.5.2

Proponents:
Paul Coats, representing American Wood Council (pcoats@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

TABLE R802.5.2
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS [g]

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		20[e]			30			50			70		
		Roof span (feet)											
		12	24	36	12	24	36	12	24	36	12	24	36
		Required number of 16d common nails per heel joint splice[a,b,c,d,f]											
3:12	12	3	5	8	3	6	9	5	9	13	6	12	17
	16	4	7	10	4	8	12	6	12	17	8	15	23
	19.2	4	8	12	5	10	14	7	14	21	9	18	27
	24	5	10	15	6	12	18	9	17	26	12	23	34
4:12	12	3	4	6	3	5	7	4	7	10	5	9	13
	16	3	5	8	3	6	9	5	9	13	6	12	17
	19.2	3	6	9	4	7	11	6	11	16	7	14	21
	24	4	8	11	5	9	13	7	13	19	9	17	26
5:12	12	3	3	5	3	4	6	3	6	8	4	7	11
	16	3	4	6	3	5	7	4	7	11	5	9	14
	19.2	3	5	7	3	6	9	5	9	13	6	11	17
	24	3	6	9	4	7	11	6	11	16	7	14	21
7:12	12	3	3	4	3	3	4	3	4	6	3	5	8
	16	3	3	5	3	4	5	3	5	8	4	7	10
	19.2	3	4	5	3	4	6	3	6	9	4	8	12
	24	3	5	7	3	5	8	4	8	11	5	10	15
9:12	12	3	3	3	3	3	3	3	3	5	3	4	6
	16	3	3	4	3	3	4	3	4	6	3	5	8
	19.2	3	3	4	3	4	5	3	5	7	3	6	9
	24	3	4	5	3	4	6	3	6	9	4	8	12
12:12	12	3	3	3	3	3	3	3	3	4	3	3	5
	16	3	3	3	3	3	3	3	3	5	3	4	6
	19.2	3	3	3	3	3	4	3	4	6	3	5	7
	24	3	3	4	3	3	5	3	5	7	3	6	9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. 10d common (3” × 0.148”) nails shall be permitted to be substituted for 16d common (3-1/2”x 0.162”) nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.

b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

e. Applies to roof live load of 20 psf or less.

f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the following factors:

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

where:

H_C = Height of ceiling joists or rafter ties measured vertically ~~above~~ from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties.

H_R = Height of roof ridge measured vertically ~~above~~ from the top of the rafter support walls to the bottom of the roof ridge.

Where H_C / H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

Commenter's Reason: This table replacement was also proposed for the IBC in code change S187-19, and there the Structural Committee made specific suggestions on S187-19 to clarify applicability of the new table. Those suggestions for improvement are reflected in this public comment for the parallel IRC table. If this public comment and the one to S187-19 are approved, the new tables will be more consistent, though there will still be some minor format differences.
In this public comment: 1) text is added to footnote "a" to clarify that results should be rounded to the next full nail; 2) a sentence is added beneath the table in footnote "f" to clarify that rafter tie connections higher than H_C / H_R = 1/3 in the attic space must be engineered; and 3) the definitions of H_C and H_R in footnote "f" are clarified to show how they should be measured.

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 only clarifies the intent of the original proposal, so no additional cost impact.

Public Comment# 1852

RB272-19

IRC: R904 (New), R905.2.4.1, TABLE R905.2.4.1, R905.1, R905.16.6, R905.17.7, ASTM, FM, ICC, UL Chapter 44 (New)

Proposed Change as Submitted

Proponents: T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

2018 International Residential Code

Add new text as follows:

SECTION R904
WIND REQUIREMENTS FOR ROOF COVERINGS

R904.1 Wind resistance for roof coverings. Roof coverings shall comply with the wind provisions and limitations of this section.

Revise as follows:

~~R905.2.4.1~~ **R904.1.1 Wind resistance of asphalt shingles.** Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table ~~R905.2.4.1~~ R904.1.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table ~~R905.2.4.1.~~ R904.1.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table ~~R905.2.4.1.~~ R904.1.1.

TABLE ~~R905.2.4.1~~ R904.1.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM FIGURE R301.2(5)A (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3(mph)	ASTM D7158[a] SHINGLE CLASSIFICATION	ASTM D3161 SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

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

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and a building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

Add new text as follows:

R904.1.2 Concrete and clay tile. In regions where wind design is required in accordance with Figure R301.2(5)B, wind loads on concrete and clay tile shall be determined in accordance with Section 1609.5 of the *International Building Code.* Concrete and clay tile shall be tested to determine their resistance to overturning due to wind loads in accordance with SBCCI SSTD 11 or ASTM C1568. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 of the *International Building Code* for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11.

In regions where wind design is not required in accordance with Figure R301.2(5)B, concrete and clay tiles shall be attached in accordance with this section or Section R905.3

R904.1.3 Metal roof shingles. Metal roof shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof shingles shall be tested in accordance with FM 4474, UL 580 or UL 1897.

R904.1.4 Mineral-surfaced roll roofing. Mineral-surfaced roll roofing shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.5 Slate shingles. Slate shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

R904.1.6 Wood shingles. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shingles are permitted to be attached in accordance with Section R905.7.

R904.1.7 Wood shakes. In regions where wind design is required in accordance with Figure R301.2(5)B, Wood shakes shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). In regions where wind design is not required in accordance with Figure R301.2(5)B, wood shakes are permitted to be attached in accordance with Section R905.8.

R904.1.8 Metal roof panels. Metal roof panels shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof panels shall be tested for wind resistance in accordance with FM 4474, UL 580, or UL 1897.

R904.1.9 Photovoltaic shingles. Photovoltaic shingles shall be tested in accordance with procedures and acceptance criteria in ASTM D 3161. Photovoltaic shingles shall comply with the classification requirements of Table R904.1.1 for the appropriate maximum basic wind speed. Photovoltaic shingle packaging shall bear a label to indicate compliance with the procedures in ASTM D 3161 and the required classification from Table R904.1.1.

R904.1.10 Building-integrated Photovoltaic roof panels. *BIPV roof panels* shall be tested in accordance with UL 1897. *BIPV roof panel* packaging shall bear a *label* to indicate compliance with UL 1897.

R904.1.11 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single ply systems, sprayed polyurethane foam, and liquid applied roof coverings shall be tested in accordance with FM 4474, UL1897 or UL 580 and installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).

Revise as follows:

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. ~~Unless otherwise specified in this section, roof~~ Roof coverings shall ~~be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3).~~ comply with the wind requirements specified in Section R904.

R905.16.6 Wind resistance. ~~*Photovoltaic*~~ *Wind resistance of photovoltaic shingles* shall be ~~tested~~ in accordance with ~~procedures and acceptance criteria in ASTM D3161. *Photovoltaic shingles* shall comply with the classification requirements of Table R905.2.4.1 for the appropriate maximum basic wind speed. *Photovoltaic shingle* packaging shall bear a label to indicate compliance with the procedures in ASTM D3161 and the required classification from Table R905.2.4.1.~~ Section R904.

R905.17.7 Wind resistance. Wind resistance of *BIPV roof panels* shall be ~~tested~~ in accordance with ~~UL 1897. *BIPV roof panel* packaging shall bear a *label* to indicate compliance with UL 1897.~~ Section R904.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

C1568-08(2013): Standard Test Method for Wind Resistance of Concrete and Clay Roof Tiles (Mechanical Uplift Resistance Method) R904.1.2

FM

FM Approvals
Headquarters Office
Norwood MA 02062

4474-2011: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures R904.1.3, R904.1.8

ICC

International Code Council, Inc.
500 New Jersey Avenue NW
Washington DC 20001

SBCCI SSTD 11-97: Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles R904.1.2

UL

UL LLC
333 Pfingsten Road
Northbrook IL 60062

580-2006: Test for Uplift Resistance of Roof Assemblies-with Revisions through October 2013 R904.1.3, R904.1.8

Reason: This proposal is one of two proposals intended to clarify the wind limitations in the IRC. Section R301.2.1.1 intends to limit the applicability of the IRC to areas where wind design is not required in accordance with Figure R301.2(5)B. However, Chapter 9 contains high wind requirements for asphalt shingles and for underlayment in wind design required regions, but for no other roof coverings. While Section R905.1 states that unless otherwise specified, roof coverings have to resist the component and cladding loads specified in Table R302(2), that requirement is not necessarily correct for all roof coverings. Prescriptive attachment methods are provided for concrete and clay tile but the code does not specify any wind limitations on the use of this prescriptive method.
Therefore, a new section is proposed for Chapter 9 on roof coverings that specifically addresses the wind limitations in the IRC for roof covering attachment and specifies the performance requirements for roof coverings in wind design required regions. It is similar to and was patterned after Section 1504 in the IBC.

This proposal is not intended to change any technical requirements in the IRC related to wind design. It is intended to simply clarify the wind requirements for roof coverings in the IRC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change proposal will not increase the cost of construction as it is primarily a clarification.

Staff Analysis: The referenced standard, ASTM C1568-08(2013), FM 4474-2011, ICC SBCCI SSTD 11-97 and UL 580-2006 are currently referenced in other 2018 I-codes.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While the intent to clarify the wind limitations is needed, the committee found the revised language confusing. (Vote: 8-3)

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IRC®: R904.1.3 (New), TABLE R904.1.3 (New)

Proponents:
T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R904.1.3 Metal roof shingles. ~~Metal roof shingles shall be installed to resist the component and cladding loads specified in Table R301.2(2), adjusted for height and exposure in accordance with Table R301.2(3). Metal roof shingles shall be tested in accordance with FM 4474, UL 580 or UL 1897.~~ Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580, or UL 1897. Metal roof shingles tested in accordance with ASTM D3161 shall meet the classification requirements of Table R904.1.3 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table R904.1.3.

TABLE R904.1.3
CLASSIFICATION OF STEEP SLOPE METAL ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ULT} FROM FIGURE R301.2(5)A (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3 (mph)	ASTM D3161 SHINGLE CLASSIFICATION
110	85	A, D, or F
116	90	A, D, or F
129	100	A, D, or F
142	110	F
155	120	F
168	130	F
181	140	F
194	150	F

Commenter's Reason: This public comment will clarify some of the confusion that occurred with the original modification. Our original modification inadvertently left out the option of using ASTM D3161 for wind resistance testing of metal roof shingles. RB279, which specifically addresses wind resistance testing of metal roof shingles was Approved as Modified by the IRC Committee. This public comment pulls the language for testing metal shingles that the IRC Committee Approved as Modified, and incorporates it within RB272. The lack of clarity on the original proposal with regard to the use of ASTM D3161 for metal shingles is resolved by this public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is only a clarification.

Public Comment# 1645

RB273-19

IRC®: R905.1.1, ASTM Chapter 44 (New)

Proposed Change as Submitted

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

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* 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 ASTM WK51913 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 attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen *underlayment* complying with ASTM D1970 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 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 *approvedunderlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II; ~~or~~ ASTM D4869 Type III or Type IV; or ASTM WK51913 shall be permitted to be installed as follows in 3.1 through 3.4:
3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
3.3.*Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19 mm) into the roof sheathing.

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ????:: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This is a placeholder for the ASTM Work Item to develop a standard related to synthetic underlayments. This will be the first ASTM Standard that applies specifically to synthetic underlayments and includes requirements that are related directly to synthetic underlayments. These requirements are much more appropriate for synthetic underlayment products than testing in accordance with the current standards which are specifically for asphalt impregnated products.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal simply adds requirements for products that are already in widespread use.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB273-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal was disapproved because the new proposed standard is not yet finalized. (Vote: 11-0)

Assembly Action: **None**

RB273-19

Individual Consideration Agenda

Public Comment 1:

IRC®: ASTM Chapter 44 (New)

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

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ~~????~~ 2019:: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Commenter's Reason: The ASTM Work Item is still in process but there is a good chance that we will have a published standard prior to the FAH in October. This will establish a standard that relates directly to synthetic underlayments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal only adds a referenced standard that applies directly and specifically to synthetic underlayments. Thus, there is no cost impact.

Staff Analysis: In accordance with Section 3.6.3.1 of ICC Council Policy 28, the new referenced standard ASTM WK51913-2019, *Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing,* must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

Public Comment# 2008

RB274-19

IRC®: R905.1.1, TABLE R905.1.1(1)

Proposed Change as Submitted

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

2018 International Residential Code

Revise as follows:

R905.1.1 Underlayment. *Underlayment* 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 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 attached in accordance with Table R905.1.1(3).

Exceptions:

~~1. As an alternative, self-adhering polymer-modified bitumen *underlayment*complying with ASTM D1970 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 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 *approvedunderlayment* for the applicable roof covering for maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips.
3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:
3.1.Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
3.2.The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
3.3.*Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
3.4.The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19 mm) into the roof sheathing.

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

Portions of table not shown remain unchanged.

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} < 140 MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} ≥ 140 MPH
Asphalt shingles	R905.2	ASTM D226 Type I <u>or Type II</u> ASTM D4869 Type I, II, III or IVASTM D6757	ASTM D226 Type II ASTM D4869 Type III or Type IVASTM D6757

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

Reason: The proposal makes two editorial changes. The alternate for ASTM D 1970 is redundant as that standard is listed in Section R905.1.1. Table R905.1.1 (1) includes ASTM D226 Type II for high wind areas; that material is also appropriate for lower wind zone areas.

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

RB274-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The committee approved this proposal based on the proponent's reason. The alternate for ASTM D1970 is redundant since it is listed in Section R905.1.1. Table R905.1.1(1) includes ASTM D226 Type II for high wind areas and is also appropriate for low wind zones. (Vote: 11-0)

Assembly Action: **None**

RB274-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R905.1.1

Proponents:
T. Eric Stafford, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

R905.1.1 Underlayment. *Underlayment* 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 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 attached in accordance with Table R905.1.1(3).

Exceptions:

1. <u>As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance to 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.</u>

2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane bearing a label indicating compliance to ~~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 ~~for maximum ultimate design wind speeds, V_{ult}, less than 140 miles per hour~~ shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips. Underlayment shall be applied in accordance with Table R905.1.1(2) using the application requirements for areas where wind design is not required in accordance with Figure R301.2(4)B. Underlayment shall be attached in accordance with Table R905.1.1(3).

3. As an alternative, two layers of *underlayment* complying with ASTM D226 Type II or ASTM D4869 Type III or Type IV shall be permitted to be installed as follows in 3.1–3.4:
   3.1. Apply a 19-inch-wide (483 mm) strip of *underlayment* parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of *underlayment* felt, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).
   3.2. The *underlayment* shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps.
   3.3. *Underlayment* shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Minimum thickness of the outside edge of plastic caps shall be 0.035 inch (0.89 mm).
   3.4. The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than $^3/_4$ inch (19 mm) into the roof sheathing.

Commenter's Reason: This public comment corrects 2 errors. While underlayment complying with ASTM D1970 is mentioned in Section R905.1.1, it is not specifically mentioned in Tables R905.1.1(1), R905.1.1(2), or R905.1.1(3). The exception is needed to maintain some of the specific criteria for the use of this underlayment such as roof ventilation and climate exposure.
The second part corrects an error related to the use 4 inch wind strips complying with ASTM D1970 over the joints in the roof deck. In areas where wind design is required in accordance with Figure R301.2(5)B, the intent was for the underlayment to be ASTM D226 Type II or ASTM D4868 Types III or IV with the enhanced fastening. This public comment makes that correction and also adds an additional modification to correlate with RB275 which was Approved as Submitted by the IRC B Committee.

This public comment also clarifies labeling language for ASTM D1970 underlayment products that is consistent with other underlayment products referenced in this section.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment will slightly increase the cost of construction. In areas where wind design is required, a heavier felt underlayment (30#) and enhanced fastening is required over the taped joints in the roof deck.

Public Comment# 1671

RB276-19

IRC®: TABLE R905.1.1(1), ASTM Chapter 44 (New)

Proposed Change as Submitted

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

2018 International Residential Code

Revise as follows:

TABLE R905.1.1(1)
UNDERLAYMENT TYPES

ROOF COVERING	SECTION	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} < 140$ MPH	MAXIMUM ULTIMATE DESIGN WIND SPEED, $V_{ult} \geq 140$ MPH
Asphalt shingles	R905.2	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM D6757 ASTM WK51913
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I ASTM D6380 Class M mineral- surfaced roll roofing	ASTM D226 Type II ASTM WK51913 ASTM D2626 Type I 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 ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM WK51913	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or Type IV ASTM WK51913
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757 ASTM WK51913	ASTM D4869 Type III or Type IV ASTM D6757 ASTM WK51913

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

Add new text as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ????: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Reason: This proposal references an ASTM Work Item for a new ASTM Standard that will appply exclusively to synthetic underlayments. The proposal simply stipulates new performance requirements for products that are already in widespread use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal references a proposed ASTM Standard that will, for the first time, apply specific performance requirements to synthetic underlayment products that are already in widespread use and will therefore not affect the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM WK51913-????, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB276-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal was disapproved for consistency with the committee action on RB273. The referenced standard is not completed at this time. (Vote: 11-0)

Assembly Action: **None**

RB276-19

Individual Consideration Agenda

Public Comment 1:

IRC®: ASTM Chapter 44 (New)

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

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

ASTM WK51913 - ~~????~~ 2019: New Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing

Commenter's Reason: The ASTM Work Item is still in process but there is a good chance that we will have a published standard prior to the FAH in October. This will establish a standard that relates directly to synthetic underlayments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal only adds a referenced standard that applies directly and specifically to synthetic underlayments. Thus, there is no cost impact.

Staff Analysis: In accordance with Section 3.6.3.1 of ICC Council Policy 28, the new referenced standard ASTM WK51913-2019, *Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing,* must be completed and readily available prior to the Public Comment Hearing in order for this public comment to be considered.

RB277-19

IRC®: R905.3.1

Proposed Change as Submitted

Proponents: Shahen Akelyan, representing LAOBS and ICC IA Basin Chapter (shahen.akelyan@lacity.org)

2018 International Residential Code

Revise as follows:

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid ~~sheathing or spaced~~ structural sheathing boards.

Reason: This section is amended to require concrete and clay tiles to be installed **only** over solid structural sheathing boards. The change is necessary because there were numerous observations of tile roofs pulling away from wood framed buildings following the 1994 Northridge Earthquake. The SEAOSC/LA City Post Northridge Earthquake committee findings indicated significant problems with tile roofs was due to inadequate design and/or construction. Therefore, the amendment is needed to minimize such occurrences in the event of future significant earthquakes. This amendment will reduce the failure of concrete and clay tile roofs during a significant earthquake and is in accordance with the scope and objectives of the Internation Building Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal limits the "spaces sheating", therefore it does not increase any cost.

RB277-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It is not appropriate that these sheathing types should not be allowed anywhere but in high seismic zones. (Vote: 6-5)

Assembly Action: **None**

RB277-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R905.3.1

Proponents:
Shahen Akelyan, representing ICC LA Basin Chapter (shahen.akelyan@lacity.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid ~~structural~~ sheathing ~~boards~~.

Exception: Spaced lumber sheathing in accordance with Section R803.1 shall be permitted in Seismic Design Categories A, B and C.

Commenter's Reason: The proposed modification to the original proposal clarifies the structural board/sheathing and adds an exception to the projects in Seismic Design Categories A, B, and C. The intent of the proposal was to have a limitation in High Seismic Area.
During the Committee Action Hearings in Albuquerque, New Mexico, we attempted to propose a floor modification that would have proposed the subject change and exception. Unfortunately, it was ruled out of order. However, with the original language, the proposal was disapproved with only 6-5 vote. The committee commented positively about the proposal and suggested to submit a public comment to bring in the floor modification.

The similar proposal and floor modification was submitted to the IBC under S25-19, and it was approved, as modified, by the committee. This proposal will be constant with the approved proposal in IBC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal limits the "spaced sheathing", therefore it does not increase any cost.

Public Comment# 1123

RB280-19

IRC®: R905.7.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Residential Code

Revise as follows:

R905.7.1 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. Spaced sheathing shall be open to the building interior and shall not be backed with spray foam or other moisture impermeable material.

Reason: Moisture is driven into the shingles by the heating of the sun. When the back or interior side of the shingles are open to air the moisture and heat has two ways to excape the shingle, toward the inside and toward the outdoors. When foam insulation is added to the back side of the shingles, there is only one escape path. The foam also stops heat transfer and builds up the temperature of the shingle, resulting in more rapid deterioration from both moisture and heat.

Bibliography: Fisette, P. Housewraps, Felt Paper and Weather Penetration Barriers:Building Materials and Wood Technology, University of Massachusetts Amherst, 2001

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes is added to a building interior during modifications. No costs are involved when following standard construction practices.

RB280-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposed language is in the wrong section. This new text is too specific for spray foam and to broad for other materials. (Vote: 11-0)

Assembly Action: **None**

RB280-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R905.7.1

Proponents:
David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.7.1 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. When wood shingles are installed over spaced sheathing the attic shall be ventilated in accordance with Section R806.1. The shingles ~~Spaced sheathing shall be open the the building interior and~~ shall not be backed with ~~spray foam or other moisture~~

~~impermeable materials~~ material that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in R905.7.1. The alternative placement of this requirement is Chapter 12, but as the issue is having the building interior surface of the shake open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shake will shorten the shakes useful life. Although most drying of the shake is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shakes and accelerates wood deterioration. Direct backing of the shakes with insulating material of any type also raises the temperature of the shake, changes the differential between interior and exterior temperature and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shingles. The installation of any product on the interior side of spaced sheathing adds to the cost of construction. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case the there is a savings in material and installation cost.

Public Comment# 1520

RB281-19

IRC®: R905.8.1

Proposed Change as Submitted

Proponents: David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

2018 International Residential Code

Revise as follows:

R905.8.1 Deck requirements. Wood shakes shall be used only 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. Spaced sheathing shall not be backed with spray foam or other moisture impermeable material.

Reason: Moisture is driven into the shakes by the heating of the sun. When the back or interior sie of teh shakes are open to air the moisture has two ways to excape the shake, toward the inside and toward the outdoors. When foam insulation is added to the back side of the shakes there is only one escape path. The foam also stops heat transfer and builds up the temperature in the shake resulting in more rapid deterioration from both moisture and heat.

Bibliography: Fisette P.; Housewarps, Felt Paper and Weather Penetration Barriers: Building Materials and Wood Technology. University of Massachusetts, Amherst 2001

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change is primarily to stop a practice that often occurs as a retrofit. It is not a normal part of any construction process or system, but can sometimes is added to a building interior during modifications. No costs are involved when following standard construction practices.

RB281-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal was disapproved for consistency with the committee action on RB280. While the concept is okay, the proposed language is in the wrong location. (Vote: 11-0)

Assembly Action: **None**

RB281-19

Individual Consideration Agenda

Public Comment 1:

IRC®: R905.8.1

Proponents:
David Roodvoets, representing Cedar Shake & Shingle Bureau (davelee@ix.netcom.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

R905.8.1 Deck requirements. Wood shakes shall be used only 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 the attic shall be ventilated in accordance with Section R806.1 The shakes ~~Spaced sheathing~~ shall not be backed with ~~spray foam or other moisture impermeable materials~~ material that prevents the free movement of air on the interior side of the spaced sheathing.

Commenter's Reason: In this case the spaced sheathing serves as the roof deck, so I believe this wording belongs in Section R905.8.1. **The alternative placement of this requirement is Chapter 8, but as the issue is having the building interior surface of the shake open to air movement to remove moisture that permeates the wood, the installation and requirement is most likely understood by the roofer. Placing anything that traps moisture in the shake will shorten the shakes useful life.** Although most drying of the shake is to the outside, there is some drying that must occur into the building. Any material that prevents the free movement of air on the interior side of the spaced sheathing prevents this drying, allowing moisture to accumulate in the bottom layer of shakes and accelerates wood deterioration. Direct backing of the shakes with insulating material of any type also raises the temperature of the shake, changes the differential between interior and exterior temperature and accelerates deterioration.

Bibliography: Jerrold E. Winand, H. Michael Barnes, Robert H. Falk; Summer temperatures of roof assemblies using western redcedar, wood-thermoplastic composite, or fiberglass shingles: FOREST PRODUCTS JOURNAL Vol. 54, No. 11

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This change is primarily to stop a practice that occurs in new construction and as a retrofit. Insulation and or other barrier products are sometimes added to a building attic interior directly to the interior side of wood shakes. The cost of installation and future problems associated with deterioration of the wood will be eliminated if the material that prevents moisture movement is not installed and the system is free to breathe and dry. So in this case the there is a savings in material and installation cost.

Public Comment# 1521

RB286-19

IRC®: AF103.7 (New), AF103.7.1 (New), AF103.7.2 (New), AF103.7.3 (New), AF103.7.4 (New)

Proposed Change as Submitted

Proponents: Dan Buuck, National Association of Home Builders, representing National Association of Home Builders (dbuuck@nahb.org)

2018 International Residential Code

Add new text as follows:

AF103.7 Sidewall Vent Termination. The vent pipe shall be permitted to be routed out the side of the building and terminated at the sidewall provided the requirements of this section are met.

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

AF103.7.2 Vent Pipe. Vent pipe joints shall be solvent welded.

AF103.7.3 Fan. A radon fan shall be installed to activate the system and shall meet the following conditions:

1. The fan shall be a listed in-line fan designed for radon mitigation and be installed in accordance with NFPA 70 and the manufacturer's installation instructions.
2. The fan shall be airtight and installed within 4 feet (1219 mm) from the point the vent passes through the wall.
3. The fan shall have ready access for repair or replacement.
4. The fan shall be connected to a system failure alarm.

AF103.7.4 Testing. The radon system shall be tested as follows:

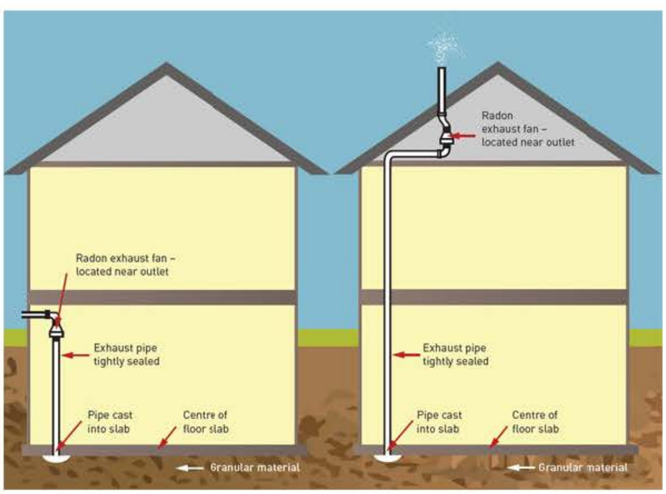
1. Testing shall be performed after the dwelling passes its air tightness test and after the radon control system and HVAC installations are complete.
2. The radon fan and HVAC system shall be operating during the test.
3. Testing shall be performed with the windows closed.
4. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit.
5. If the test result is 4 pCi/L or greater, then the system shall be modified and retested until the test result is less than 4 pCi/L.
6. The final test results shall be included with the construction documents.

Reason: The intent of this proposal is to allow sidewall venting of radon reduction systems without changing the other provisions of Appendix F. An active system is required if the sidewall venting option is chosen, but builders and owners still have the option of constructing a passive through-the-roof system. The sidewall termination option can provide advantages for those who have already decided to install a radon fan and want the benefits of simple vent routing or want to have better access to the fan for monitoring and maintenance. The side-vent option reduces ice formation on the roof vent. In cold climates ice forms on the roof vent as warm moist air meets cold outdoor air.

Research used to substantiate the U.S. requirement for roof venting (Henschel, 1995) showed a negligible re-entrainment level of 0.07 pCi/L when a concentration of 25 times the EPA action level was being exhausted at grade level. At the action level of 4 pCi/L the calculated re-entrainment level would be a negligible 0.003 pCi/L. This same research has been used as substantiation to allow sidewall radon vent termination in Canada (see Health Canada, *Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors*). Recent additional testing summarized below supports this view.

The following is from *Summary Report on Active Soil Depressurization (ASD) Field Study* (Health Canada, 2016), emphasis added. The 200 Bq/m^3 in the quoted text below is the Canadian action level for radon.

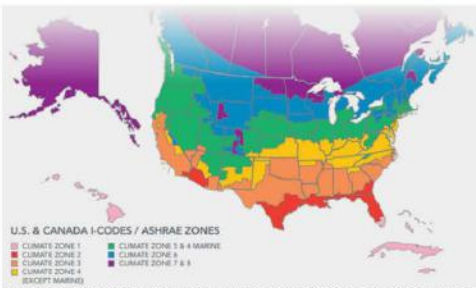
> "The second part of the study investigated how quickly radon levels dissipate with distance away from the side-wall discharge point. To do this, real-time radon dispersion measurements were conducted at 5 homes. At each home, arrays of approximately 10-15 continuous radon monitors were set up at fixed heights and distances away from where the exhaust is expelled, and measurements were conducted for a continuous period of roughly 6 hours. Generally speaking, radon levels fell from thousands of Bq/m^3 to less than the 200 Bq/m^3 guideline value within 1-2 metres, indicating a rapid decrease with distance.
>
> "The long-term indoor post-mitigation results indicate that radon levels can be successfully lowered, and maintained, to levels well below the Canadian guideline value using an ASD mitigation system with an indoor mounted fan and side-wall discharge. This further implies that indoor leakage of radon from the system, and re-entry of radon into the home from the exhaust stream, were not issues of concern for the systems tested. As predicted, extreme cold climatic conditions did not cause freeze-up issues or impact the function of the ASD fan or system, as system components were not directly exposed to harsh conditions in the way they may be with the traditional geometry. The alternative, and conveniently less expensive, ASD geometry has been shown to be quite viable."

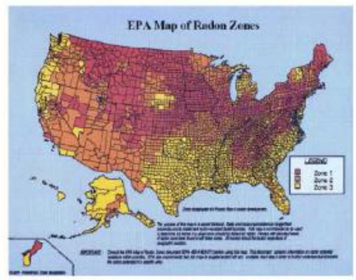


A sidewall termination can also be beneficial in cold climates where water vapor can freeze at the termination of tall, uninsulated systems, closing off the vent.

"Condensation problems can be reduced if the exhaust is discharged from a short pipe near ground level at right angles to the wall; similar to the exhausts from fan powered combustion appliances. ... A major advantage in cold weather areas is that the exposed discharge pipe is short and horizontal, reducing condensation and frost problems." (Health Canada, *Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors*).

When considering how big of an issue freezing can be, it's important to note that most of the Canadian population lives near the U.S. border in climate zone 6, which is the same climate zone that covers a significant portion of the northern U.S. This is demonstrated in the figure to the left which shows IECC climate zones extended into Canada. Coincidentally, the same region covers much of radon zone 1.

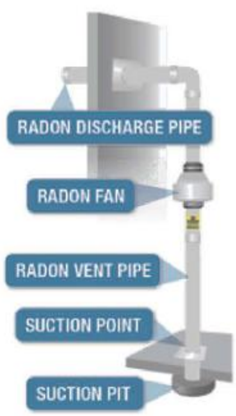




(Map credit: www.greenbuildingadvisor.com/article/climate-zone-map-including-canada)

The proposed language for the vent termination clearances was taken from IRC Section G2427.8 where it applies to a mechanical draft venting system. The power source for a future fan is adequately addressed in AF103.12.

The Canadian – National Radon Proficiency Program (C-NRPP) also recognizes sidewall terminations for radon reduction systems and shows the following image on its website (https://c-nrpp.ca/radonreduction/). The C-NRPP was established in 2014 as an agreement between the Canadian Association of Radon Scientists and Technologists and Health Canada.



Bibliography: Henschel, D. (1995). Re-Entrainment and Dispersion of Exhausts from Indoor Radon Reductions Systems: Analysis of Tracer Gas Data. Indoor Air 5(4):270-284. https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=128594.
Health Canada. (2010). Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors. www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-eng.php.

Health Canada. (2014). Radon Reduction Guide for Canadians. www.canada.ca/en/healthcanada/services/environmental-workplace-health/reports-publications/radiation/radonreduction-guide-canadianshealth-canada-2013.html.

Health Canada. (2016). Summary Report on Active Soil Depressurization (ASD) Field Study. www.canada.ca/en/healthcanada/services/environmental-workplace-health/radiation/radon/summary-report-activesoil-depressurization-

fieldstudy.html.

"Understanding a Radon Mitigation System." Canadian – National Radon Proficiency Program, https://cnrpp.ca/radonreduction/.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Installing an active radon system with a sidewall termination is an option, and the passive, through-the-roof option is still available.

RB286-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The proposal provides options and cost savings. The historical nature of the information from Canada cannot be denied. It is proven to work. The committee requested that the proponent clean up some of the language in the public comment period. (Vote: 7-4)

Assembly Action: **None**

RB286-19

Individual Consideration Agenda

Public Comment 1:

IRC®: AF103.7.2 (New)

Proponents:
David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.2 Vent Pipe. Vent pipe joints shall be solvent welded. Above ground piping shall be supported by the structure of the building using hangers or strapping designed for piping support.

Commenter's Reason: Without structural support of the radon system piping the pipe could easily get dislodged and result in a catastrophic failure where radon gas is actively pumped into the structure.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Estimate an additional $5 cost to secure the pipe.

Public Comment# 1797

Public Comment 2:

IRC®: AF103.7.4 (New)

Proponents:
David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.4 Testing. The radon system shall be tested as follows:

1. Testing shall be performed after the dwelling passes its air tightness test and after the radon control system and HVAC installations are complete.
2. The radon fan and HVAC system shall be operating during the test.
3. Testing shall be performed with the windows closed.
4. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit.
5. <u>Testing shall be performed with a commercially available radon test kit; or testing shall be performed by an approved third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer's instructions</u>.
6. If the test result is 4 pCi/L or greater, then the system shall be modified and retested until the test result is less than 4 pCi/L.
7. The final <u>written </u>test ~~results~~ <u>report with results less than 4 PCi/l </u>shall be ~~included with the construction documents.~~ <u>provided to the code official.</u>

Commenter's Reason: Clarifies the testing procedure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Radon test kits are inexpensive, less than $50 for the two test kits including laboratory determination of results. Tests by radon professionals will likely be more expensive.

Public Comment# 1798

Public Comment 3:

IRC®: AF103.7.3 (New)

Proponents:
David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.3 Fan. A radon fan shall be installed to activate the system and shall meet the following conditions:

1. The fan shall be a listed in-line fan designed for radon mitigation and be installed in accordance with NFPA 70 and the manufacturer's installation instructions.
2. The fan shall be airtight and installed within 4 feet (1219 mm) from the point the vent passes through the wall.
3. The fan shall have ready access for repair or replacement.
4. The fan shall be connected to a system failure alarm.
5. <u>Piping joints and connections to fans and other components that are subject to fan- induced positive pressure shall be tested for leakage while the system is operating normally. Leak tests shall be conducted with a liquid bubble solution or an approved method.</u>

   <u>System components found to be leaking shall be corrected in a manner recommended by the component manufacturer and the system shall be retested. Where system fans are tested with a liquid bubble solution, such fans shall be designed for outdoor installation.</u>

   <u>After successful completion of the leak testing, a label shall be applied to the radon fan. The label shall read as follows:</u>

   <u>**"This system was tested for leaks during installation. Physical damage to or aging of the system could result in leakage that can increase indoor radon levels. It is advised that your radon system be routinely inspected and your radon levels be retested every 2 years or after structural changes to your home."**</u>

Commenter's Reason: This important leak test and labeling to provide notice to the occupants is a requirement in the Canadian Standard that RB286-19 was based upon. There is no justification for not requiring a leak test and warning to occupants for fans being mounted inside the thermal envelope. The section of the Canadian standard is reprinted here.

<u>**7.3.3 Conditions for mounting active soil depressurization fans indoors**</u>

7.3.3.1 **Fan criteria**

7.3.3.1.1 The radon fan used shall meet the product safety requirements in accordance with CAN/CSA-C22.2 No. 113 and the motor shall comply with the applicable requirements of CAN/CSA-C22.2 No.100 for motors having continuous duty.

7.3.3.1.2 The radon fan seams and enclosure openings other than the inlet and outlet ports, shall be sealed so that the combined area of all gaps or openings of the fan housing shall not exceed a total area of a single 3.17 mm (0.125in.) diameter hole which would result in a maximum 0.425 m3/h [0.25 cubic foot per minute (cfm)] leakage at 375 Pa (1.5in. WC pressure).

7.3.3.2 Leak test

7.3.3.2.1 The installer shall check each connection, fan joint and system component subject to fan- induced positive pressure while under normal operating pressure with either a liquid bubble solution or a leak-detection device to locate any source of a leak.

7.3.3.2.2 The installer shall seal any detected leak in a manner recommended by the component manufacturer and retest.

7.3.3.2.3 Fans requiring bubble leak testing or fans installed outdoors shall meet the requirements of CAN/CSA 22.2 No. 113 for outdoor use.

7.3.3.2.4 Leak test exception

Radon fans mounted outdoors, in attics or attached garages, or radon fans with all critical seams under

negative pressure or housed in a negative pressure enclosure shall not require a leak test.

7.3.3.3 Labelling

After completion of the leak test, a label shall be applied to the radon fan by the installer. The label shall contain the following information:

“The Installer has tested this system for leaks during installation. Please note that physical damage or aging may result in leakage which can increase indoor radon levels. You are advised that your system should be routinely inspected and your radon levels retested every 5 years or after major structural, or ventilation/air circulation equipment changes to your home.”

« L’installateur a soumis ce système à un essai d’étanchéité durant son installation. Veuillez noter que tout dommage matériel ou vieillissement pourrait provoquer une fuite qui, à son tour, pourrait faire augmenter la concentration de radon dans l’air intérieur. Il vous est conseillé d’inspecter régulièrement votre système et de mesurer la concentration de radon tous les cinq ans ou après des modifications importantes apportées à la structure, à l’équipement de ventilation ou au système de circulation d’air de votre habitation. »

Bibliography: Canadian General Standards Board (CGSB) CAN/CGSB-149.11-20xx “*Radon control options for new construction in low-rise residential buildings”*
https://www.carst.ca/resources/Documents/CGSB-149.11-2015CD-01.pdf

Health Canada. (2010). Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors. www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radon_contractors-entrepreneurs/index-eng.php.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Estimated cost increase is $5 to perform this simple. test and apply label.

Public Comment# 1802

Public Comment 4:

IRC®: AF103.7.1 (New)

Proponents:
Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, Spruce Environmental Technologies, Inc., representing AARST & Spruce Environmental Technologies, Inc.

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than ~~4~~ 6 feet (~~1219~~ 1829 mm) below, ~~4~~ 6 feet (~~1219~~ 1829 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

Commenter's Reason: The single purpose of a radon system is to prevent occupant exposure to radon by sucking the radon from under the ground into an airtight pipe assembly and exhausting it outside the building. The only proven method is to exhaust the radon above the roof, which is far from occupants.
The proposed clearances for sidewall venting between the radon system vent termination and windows, doors, and gravity air intake openings into the building are not protective. The mechanical draft venting provision for fuel gas appliances contained in IRC Section G4247.8 to an exhaust pipe was not designed for preventing exposure to radioactive cancer-causing radon gas.
The Canadian standard - CGSB 149.11 - on which this sidewall venting code change proposal was based - requires two meters (6.5 feet) clearance from windows and gravity air inlets and recommends same for doors. We propose that the clearance be 6 feet. We would note that the ANSI-AARST CCAH standard requires 10 feet.
The following table displays clearances for doors, windows, and gravity air inlets from the Canadian and American National consensus standards, those contained in the code change proposal and ones contained in this comment.

Required Clearances for Radon Gas Exhaust				
Location	CGSB 149.11 **in meters (ft)**	ANSI-AARST CCAH	NAHB Proposed AF103.7.1	**This Modification**

Clearance to air supply inlet	2 (6.5 ft)	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from
Clearance from a window	2 (6.5 ft)	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from
Clearance from a door	1 (3.25 ft) required; 2 (6.5 ft) recommended;	10 ft from, 2 ft above	4 ft below, 4 ft from, 1 ft above	6 ft from

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The incremental cost of the code change is $2 for 2' of extra pipe material.

Public Comment# 1924

Public Comment 5:

IRC®: AF103.7.1 (New)

Proponents:
Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF103.7.1 Vent Location. The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).
2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.
3. Not over ~~public~~ walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.
4. Not less than 12 inches (305 mm) above finished ground level.

Commenter's Reason: The single purpose of any radon system is to prevent occupant exposure to radon by sucking the poison from under the ground into an airtight pipe assembly and exhausting it outside the building. The only proven method is to exhaust the radon above the roof, which is far from occupants.
The prohibition of installation over public walkways is an important protection. The same attention should be extended to all walkways: the owner/occupants of the property deserve the same protection as neighbors/passersby.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The modification does not change the materials and labor cost of the radon system.

Public Comment# 1923

Public Comment 6:

Proponents:
Bill Angell, University of Minnesota, representing North Star AARST (wangell@umn.edu)

requests Disapprove

Commenter's Reason: 1. Radon is radioactive and is the most severe environmental health risk in the home. As such, it is appropriate for public health policy to set risk level at low as reasonably achievable (ALARA). Research clearly indicates indoor fans and sidewall fan discharges violate ALARA and thus, should not be allowed.

1.1. The greatest house infiltration occurs at or near the rim joist - - - sidewall discharges are at this vulnerable point. Available research indicates rerouting ASD exhaust above the highest roof level reduces indoor radon concentrations.

   1.2. Indoor radon fans pose a serious health risk due to radon leaks as an increasing number of exhaust pipe and fan connectors disconnect with age.
   1.3. Compared to combustion appliance exhaust, soil gas exhaust is cooler and thus, has a greater tendency to pool near the discharge and re-entrain into the building as well as increase potential outdoor exposure.
   1.4. The World Health Organization reviewed radon ASD fan and discharge locations made a consensus recommendation consistent with U.S. ANSI/AARST mitigation standards.
2. NAHB claims sidewall discharges have a benefit of remaining ice-free yet there is no available research that supports the NAHB claim. Furthermore, decades of interior routed, above roof ASD discharges in the northern U.S. have not produced significant freeze-up issues.
3. The stated rationale of the NAHB proposed IRC Appendix F change assumes a relatively low level of radon concentration (100 pCi/L) while the discharge concentration can be significantly greater (10 to 50 times greater).
4. Research cited by NAHB to support its indoor fan and sidewall discharge proposal has serious limitations NAHB fails to cite.
   4.1. Several research papers recommend assessments during warm seasons (when the pooling of cool soil gas on the ground surface and re-entrainment are most likely) yet, that research is not available.
   4.2. No research addresses the risks of outdoor exposures of children playing in high soil gas concentrations nor adults occupying areas near sidewall discharges. Radon concentrations within 6 feet of sidewall discharge average 15 times background
5. The radon testing component of the NAHB radon sidewall discharge proposal fails to follow ANSI/AARST mitigation standards and thus, may result in elevated indoor radon exposure.

Bibliography: · Brossard, M., Ottawa, C., Falcomer R., Whyte, J., 2014 Radon mitigation in cold climates at Kitigan Zibi Anishinibeg, *Health Physics*, 108(1S), S13-S18

- Health Canada 2016 *Summary Report on Active Soil Depressurization (ASD) Field Study* Ottawa, ON: Health Canada.
- Henschel, DB 1995 Re-entrainment and dispersion of exhausts from indoor radon reduction systems: Analysis of tracer gas data, *Indoor Air*, 5: 270-284.
- Henschel, DB 2004 Cost analysis of soil depressurization techniques for indoor radon reduction, *Indoor Air*, (April).
- Hunter, AR 1995 Spatial and temporal variations of soil gas ^{220}Rn and ^{222}Rn at two sites in New Jersey *Proceedings of the 1996 International Radon Symposium*, Fletcher, NC: AARST.
- Maeda, L and Hobbs, W 1996 Outdoor radon concentrations in the vicinity of an active home radon mitigation system, *Proceedings of the 1996 International Radon Symposium* (I1 -4.7), Fletcher, NC: AARST.
- Moorman, L 2016 Radon discharge locations that are shown to affect interior radon concentrations negatively, *Proceedings of the 2016 International Radon Symposium*, Fletcher, NC: AARST.
- Neff, D, Meroney, R and El-Badry, H *1994a Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Final Report). Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University.
- Neff, D, Meroney, R and El-Badry, H *1994b Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Project Summary); EPA/600/SR-94/115). Research Triangle Park, NC: Air and Energy Engineering Research Laboratory.

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# 2017

Public Comment 7:

Proponents:
Thomas Bowles, United States Environmental Protection Agency, representing United States Environmental Protection Agency (bowles.thomas@epa.gov)

requests Disapprove

Commenter's Reason: From a public health standpoint, sidewall venting in radon mitigation systems is not considered a best practice. EPA does not support sidewall venting as described in the proposal; the construction methodology lacks adequate safeguards to protect against concentrated radon blowing directly into an enclosed space, in the event a pipe breaks or is damaged. As written, the proposal suggests the vent should pass through the wall of a home. When the pressurized side of the system is inside the home, breakages and penetrations in the fan housing or pipe will leak directly into the home and could present a very high-risk exposure scenario.

The potential for damage and component failure exists in any radon mitigation system. This proposal does not require adequate safeguards.

Occupants will not receive a warning in the event a pipe is damaged or leaking. This means an occupant would be unaware if highly concentrated radon was leaking into a conditioned space. The proposal references Canadian guidance (Reducing Radon Levels in Existing Homes: A Canadian Guide for Professional Contractors) to support the position of sidewall venting; however, it lacks a critical safeguard the Canadian guidance requires which is the installation of a continuous radon radiation monitor (CRM). The addition of a CRM could alert occupants to flaws in the system and prevent exposures that can cause lung cancer. Some stakeholders have argued in support of the proposal, by referencing codes that allow other dangerous gasses, such as carbon monoxide (CO), to be generated inside the conditioned space and exhausted outdoors through pressurized pipes located within the building envelope. However, in every case where this is true, the code requires the use of a CO monitor. (2015 IBC Section 915) As written, this proposal does not require a CRM, which is inconsistent with other codes addressing dangerous gasses and lacks necessary public health protections. (National Standard of Canada 5.1.7)

The proposal does not do enough to address re-entrainment of radon gas re-entering the home through windows, vents, or other pathways after it is exhausted outside. There is not enough evidence to show a vent termination located 4' below an open window (RB286-19, AF103.7 Vent Location 2.) does not pose a potential health risk through re-entrainment.

Finally, the proposal seeks to support sidewall venting by stating that it can be beneficial in cold weather climates due to condensation and freezing concerns. In a comparative study on different options for fans and exhausts positioning, "Icing occurrences were found in similar numbers in January 2011 for both exhaust scenarios." While active soil depressurization systems that exhaust above the roof line proved to be 3.5 times more susceptible to obstructive icing, in the study, the side-venting is not immune. During the study when temperatures reached below -20 degrees C° "only one case of severe obstruction (more than 50% of pipe area) was reported" for the above the roof line discharges in the study and, "neither radon reduction nor suction pressures were im-paired in this worst case." (**Anishinabeg et al, 2012)**

Sources Utilized

2015 IBC Section 915 https://codes.iccsafe.org/content/IBC2015/chapter-9-fire-protection-systems

National Standard of Canada http://publications.gc.ca/collections/collection_2017/ongc-cgsb/P29-149-012-2017-eng.pdf

Residential Radon Mitigations at Kitigan Zibi Anishinabeg: Comparison of Above Ground Level (Rim Joist) and Above Roof Line Discharge of Radon Mitigation Sub-Slab Depressurization Systems, M. Brossard, M. Brascoupé, C. Brazeau-Ottawa, R. Falcomer, W. Ottawa, and J. Whyte, Health Physics, V 102, pp S43-S47, May 2012.

RB286-19 AF103.7.1 Vent Location.

The vent termination shall be located:

1. Not less than 3 feet (914 mm) above any forced-air inlet located within 10 feet (3048 mm).

2. Not less than 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, operable window or gravity air inlet into any building. The bottom of the vent terminal shall be located not less than 12 inches (305 mm) above finished ground level.

3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.

4. Not less than 12 inches (305 mm) above finished ground level.

Bibliography: 2015 IBC Section 915 https://codes.iccsafe.org/content/IBC2015/chapter-9-fire-protection-systems

National Standard of Canada http://publications.gc.ca/collections/collection_2017/ongc-cgsb/P29-149-012-2017-eng.pdf

Residential Radon Mitigations at Kitigan Zibi Anishinabeg: Comparison of Above Ground Level (Rim Joist) and Above Roof Line Discharge of Radon Mitigation Sub-Slab Depressurization Systems, M. Brossard, M. Brascoupé, C. Brazeau-Ottawa, R. Falcomer, W. Ottawa, and J. Whyte, Health Physics, V 102, pp S43-S47, May 2012.

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The vent termination shall be located:

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3. Not over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves or other equipment.

4. Not less than 12 inches (305 mm) above finished ground level.

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# 1991

Public Comment 8:

Proponents:
Gary Hodgden, AQP Inc, representing Self (gary@aair.com)

requests Disapprove

Commenter's Reason: Attached are more details.
My objection speaks to words in the ICC code of ethics as phrased many ways in a dozen publications:
"The protection of the health, safety and welfare of the public by creating safe buildings and communities is the solemn responsibility of the International Code Council ("ICC") and all who participate in ICC activities."
The overwhelming health hazard:
The proposal assumes no responsibility for an inevitable number of incidental damage events that will occur to fan/pipe connections to result in blowing extremely hazardous exhaust directly into conditioned space. This can occur simply when moving furniture or with teenagers wresting in a basement.
As such, these designs are effectively illegal in almost a dozen states.
For this safety concern, the proposal does NOT include any of the following:

- Requirements for strapping and supports that would prevent any movement to piping or fans so that the likelihood of pipes falling loose would be less;
- Labeling to warn occupants of the hazard if pipes fall loose;
- Labeling for what system is or for system failure alarms; or
- A radiation monitor that would alert occupants if the pipe falls loose.

The proposal also does NOT account for:

- A requirement, “the discharge shall be directed away from the building” that is an integral part of in similar code text for mechanical draft vents M1804.2.6. Without this requirement, all safety distances cited from openings are inadequate.
- A requirement, “shall not blow exhaust air that can contain chemical vapors at people”
- Fan driven exhaust air that encounters irregularities in construction, such as a ½ inch gap where the roof eave meets the siding
- Safe distances from other buildings (e.g., 20 ft)

Studies cited on exhaust air entering the building

The proposal casually dismisses conclusions of building and radiation scientists who spent years studying the issue for EPA. Instead, this proposal favors a publication written by a manufacturer of a side-vent fans who selectively omitted or did not understand portions of one very limited and truncated EPA publication.

Misconstrued premise: Ice

A justification for the proposal erroneously includes concerns of ice formation at roof-vents, as experienced in Canada for exterior exhaust piping. But Canada requires interior piping for new construction.

It is a simple fact that “warm moist air” exhausted into “freezing air” can form ice at any location.

Reference titles and links:

Full Comment NAHB RB286-19 Proposal-GaryHodgden
https://drive.google.com/file/d/1viPVFrzLC3a5bVToVyUI5cjxi1EkEGjZ/view?usp=sharing

Moorman in 2016 *(Radon Discharge Locations That Are Shown To Affect Interior Radon Concentrations)*
https://drive.google.com/file/d/1kBhKdgTbowcnmOpfkr6cXwzc2ED0x5Pi/view?usp=sharing

ASHRAE research project 1635-TRP that reveals the problems *(“Simplified Procedure for Calculating Exhaust/Intake Distances”)*
https://drive.google.com/file/d/1rzmYnNnYp1bmkq0g46cGi8mTB3P2pdzS/view?usp=sharing

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# 1484

Public Comment 9:

Proponents:

Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

requests Disapprove

Commenter's Reason: Sidewall radon venting is not a proven method of excluding radon from the home environment. The cancer risks to occupants indoors from re-entrainment of radon into the building, and to occupants or anyone else who spends more than ten minutes outdoors near the point of exhaust from the radon system far outweigh the benefits claimed by the advocates for this proposal. Further, the unrealistic value of 100 pCi/L the proponents cite in their re-entrainment calculations does not address homes with radon potentials as high as 6,176 pCi/L found in Pennsylvania.

This proposal is not code-ready: research is needed to clarify that such system will not cause new exposure risk for occupants, children playing outside and passersby. Specifically, we know of no definitive peer-reviewed research that indicates that sidewall venting is as effective year-round, or in all climates and building types, compared to roof-top discharge. *To the contrary, anecdotal evidence from US radon system professionals, as well as a study of 97 homes in New Jersey, have demonstrated the potential for increasing human exposure to radon from sidewall venting.*

We simply don’t know whether it never or always results in indoor radon levels higher than roof top exhaust, or that ground-level exhaust always or never exposes persons spending time near that ground-level exhaust. We do know that roof-top exhaust in a properly installed system will reduce indoor radon levels and will not expose persons (unless they choose to spend leisure time on the roof not designed for human occupancy). *Why allow into Appendix F a risky business proposition that will haunt code officials who sign off on it and builders who implement it and design professionals who prescribe it?*

When radon gas is discharged via a radon mitigation system above the roof, the radon concentration falls off dramatically from the point of discharge, to as low as background levels below the discharge point. Ground level discharge of radon has been disallowed in the US since the early 1990s, primarily because of the potential for re-entrainment of the gas into the house and the potential leakage from the fan and piping inside the building envelope.

The proponent rationale for sidewall venting in cold climates is unproven: *obstructive icing of a radon pipe is not a common problem in the experience of radon professionals in the US, and the one Canadian study that documented it found only 50% ice blockage - on one of 63 homes –*

and there was no reduction in mitigation performance.
It must be noted that the only current US consensus standard for radon control in the new construction of one and two family homes, ANSI-AARST CCAH, requires that radon systems exhaust at least 10 feet from ground level. Why? The evidence (presented in the bibliography and by others) is clear: *soil gas exhaust at ground level has significantly higher levels of radon than rooftop soil gas exhaust.*

Bibliography: **1. Studies relevant to this subject**

Bernier, J and Brossard, M 2013 *Outdoor Radon Dispersion: Comparison of Lateral vs. Vertical Exhaust of Radon Sub Slab Depressurization Systems*, Maniwaki, QB: Kitigan Zibi Anishinabeg and Montreal, QB: Health Canada Quebec Regional Office (June 20 Teleconference)
This paper reviewed above ground level (lateral) (AGL) and above roof level (ARL) discharges, using six-minute grab samples and 45 day detectors in October and November 2012. The authors note that *most of lateral AGL dispersion of elevated radon occurs within the first 2 meters (6.5 feet) of exhaust* and recommend clearance for outdoor occupancy areas (e.g., balcony, terrace) as well as study of indoors and during warm weather.
Brodhead, B Clarkin, M and Brennan, T 1993 Initial results from follow-up of New Jersey homes mitigated for radon, *Proceedings of the 1993 International Radon Symposium*), Fletcher, NC: AARST
This project involved house diagnostics and four quarterly E-PERM measurements taken in three locations at 97 single-family homes in New Jersey. Houses with elevated post mitigation results were included in the selection so that mitigation failures could be located and evaluated. Measurements were made of the radon system exhaust and revealed radon concentrations as high as 485 pCi/L and thoron levels as high as 10,000 pCi/L. A second phase of the study included follow-up work at fifteen of the original houses that had at least one quarterly measurement elevated. Additional diagnostics and system alterations were done on these houses to improve the performance of (he initial mitigation. **Two homes with sidewall venting were shown to have re-entrainment which caused elevated indoor radon levels.**
Brossard, M., Ottawa, C., Falcomer R., Whyte, J., 2014 Radon Mitigation in Cold Climates at Kitigan Zibi Anishinibeg, *Health Physics*, 108(1S), S13-S18
While this study indicates that a sealed radon fan having proper fittings and sealed piping in one-story homes was able to reduce the radon to acceptable levels with above ground discharge, and that these installations were less subject to obstructive icing of the exhaust in cold climates, it also showed that there was only a single instance of obstructive icing among homes with roof top discharge and the icing did not interfere with radon reduction. The authors noted the need to repeat the study in homes with more than one story, during the warm weather, and in urban and suburban homes.
Moorman, L 2016 Radon Discharge Locations that are Shown to Affect Interior Radon Concentrations Negatively, *Proceedings of the 2016 International Radon Symposium*, Fletcher, NC: AARST
This study reviewed two passive radon mitigation systems installed as RRNC during new home construction with high radon concentrations larger than the EPA action level. By process of elimination, the discharge locations were the last potential cause. Rerouting the vent pipes to bring the discharge location in compliance with current standards lowered the radon levels in these re-entrainment cases. The author presented a comparison of radon discharge and flue gases, noting “one can state that flue gas is very noticeable and an immediate deterrent when the public is around it, whereas radon discharge gas is not noticeable and thus not a deterrent for the unsuspected public.”

	Flue Gases	**Radon**
Timing	Intermittently operating	Constant operation
Smell	Detectable odor when on	Odorless
Sound	Considerable sound when on	Generally, background sound
Visual	Smoke cloud when on	Transparent
Temperature	Warm or hot when on	Cool
Health Concern	CO at start, then CO_2 when on	Radioactivity

Neff, D, Meroney, R and El-Badry, H *1994a Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Final Report). Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University
The objective of this study was to identify whether there are conditions under which the mitigation radon exhaust for typical homes can safely be released at grade level. The results from these tests determined that:1) Exhaust gases will recirculate heavily into the house wake for all three effluent sources tested whenever the stacks are located downwind of home's roof crest; 2*) The at-grade wall release location usually leads to the highest building surface concentration values.* The eave release location leads to somewhat higher concentrations than the roof release location; 3) Source strengths of 100 pCi/L produced concentrations greater than the design value of 1 pCi/L only for wall releases, and the maximum of these was only 1.4 pCi/L. Source strengths of 1000 pCi/L produced concentrations greater than design value of 1 pCi/L at sampling locations for all three effluent release locations.
A related paper (**Neff, D, Meroney, R and El-Badry, H *1994b Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses* (Project Summary; EPA/600/SR-94/115). Research Triangle Park, NC: Air and Energy Engineering Research Laboratory)** noted: The tracer gas results show that grade-level exhausts consistently result in the highest tracer concentrations against the face of the house, although these concentrations may not be serious if exhaust concentrations are low. The highest concentration measured at one point against the side of the house over all runs with grade-level exhaust would correspond to 30 Bq/m3 (0.8 pCi/L) if the exhaust contained 3,700 Bq/m3 (100 pCi/L), and 300 Bq/m3 (8.1 pCi/L) if the exhaust contained 37,000 Bq/m3 (1,000 pCi/L).

2. Additional Lessons from Studies Cited by The Proponent

Health Canada 2016 *Summary Report on Active Soil Depressurization (ASD) Field Study* Ottawa, ON: Health Canada
www.canada.ca/en/healthcanada/services/environmental-workplace-health/radiation/radon/summary-report-activesoil-depressurization-fieldstudy.html.

1) There is no evidence supporting the claim that a vertical roof-top ASD discharge is “highly susceptible to ice or snow blockage.”
2) Authors recommend follow-up study of long-term performance.

Henschel, DB 1995 Re-entrainment and dispersion of exhausts from indoor radon reduction systems: Analysis of Tracer Gas Data, *Indoor Air*, 5: 270-284

1) Tests in the field suggest that active soil depressurization systems exhausting at grade level can contribute indoor radon concentrations 3 to 9 times greater than systems exhausting at the eave;

2) Grade-level exhaust can contribute mean concentrations beside houses averaging 7 times greater than exhaust at the eave, and 25 to 50 times greater than exhaust midway up the roof slope; and

3) Exhaust location was found to have a statistically significant ($p<0.0001$) effect on re-entrainment with grade-level exhaust having greater impact on indoor radon concentrations in a home where the concentrations were relatively low.

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# 1900

Public Comment 10:

Proponents:
Ruth Mcburney, Conference of Radiation Control Program Directors, representing Conference of Radiation Control Program Directors (rmcburney@crcpd.org)

requests Disapprove

Commenter's Reason: The Conference of Radiation Control Program Directors (CRCPD) is a nonprofit non-governmental professional organization dedicated to radiation protection. With these comments, the CRCPD is representing the state radon programs in the United States. Much like how the ICC is focused on protection of the health, safety, and welfare of the public, the CRCPD's primary goal also focuses on public health through working to assure that radiation exposure is kept to the lowest practical level.

Radon is a cancer causing radioactive gas found in the soil that enters buildings throughout the United States. Part of CRCPD's mission is to work with states and tribes to reduce the lung cancer burden by lowering radon in buildings. The goal of radon reduction is to get it as low as reasonably achievable (ALARA). The NAHB sidewall discharge proposal RB286-19 violates the protocols and standards approved in the United States for radon mitigation and increases the health risk to our citizens through an increased risk of elevated radon exposure.

There are numerous reasons why this proposal will put the health, safety and welfare of the public at increased risk. The amount of radon in the soil is 100s or 1,000s times greater than what enters a typical structure and many times greater than the cited values from the Canadian research referenced by the proposal's author. Radon should be kept out of and as far away from the structure as possible.

1. Extensive field experience and scientific research in the United States has shown improperly vented radon system exhaust points such as included in the RB286-19 proposal can lead to radon re-entering the structure. The research provided in support of the RB286-19 proposal lacks statistical credibility. We have a strong and documented history of radon mitigation systems successfully lowering radon exposures. There are more than one million radon mitigation systems installed in the US which are properly vented and do not pose a threat to the health and safety of unsuspecting occupants.
2. Radon fans located in the conditioned space of the building can leak and thereby increase the amount of radon in the building without anybody knowing. A system with the radon fan located inside the home puts the family at greater risk.
3. Positively pressurized radon system piping located indoors can leak and allow highly concentrated levels of radon and other soil gasses into the structure increasing exposure to radon and other unknown soil gas contaminants to the public. Many of these contaminants can be very toxic.
4. Venting radon systems as proposed will violate **multiple** state regulations currently in place throughout the country. The methods proposed in RB286-19 are illegal in every state which has a regulatory program for radon mitigation and violate established standards and protocols in the United States
5. Justification for this proposal incorrectly uses existing exterior radon system freeze-ups as a reason to limit the amount of pipe exposed outdoors. In new construction, systems are routed through the interior of the house through the roof thereby limiting the amount of uninsulated pipe exposed to the elements. Field experience from Minnesota, where a variation of Appendix F has been in energy or building code for ten years, shows interior pipe routes do not freeze up in the winter. The issues presented by the author mix up the Canadian examples of exterior radon mitigation systems installed **after** construction with systems installed preconstruction (routed interior through the roof that do not freeze in a cold climates).
6. If a radon system as prescribed in this proposal was to fail, it would put the inhabitants at a 100-1000x greater exposure to radon and any other soil gas or vapors that may be under the building. This includes Volatile Organic Compounds (VOCs) including methane, TCE and other VOCs and carcinogens. Because we are not able to continually monitor radon or other soil gas contaminant levels in homes with a practical and low-cost method, there is no means for the occupants to know if they are being exposed to these dangerous chemicals and carcinogens.

7. Venting radon systems like flue gases from modern power vented appliances is not a safe practice. The radon concentrations leaving the exhaust point can be extremely high and have a virtually unlimited supply. Unlike flue gases which are not continuously vented and are easily recognized, radon exhaust is continuous and is an invisible, odorless, colorless radioactive gas.
8. Installation of active radon systems as proposed will burden the builder with increased installation costs and increased liability. The liability of the home builder for lung cancer cases in people is much higher when they install these systems knowing that the system potentially causes greater radon exposure to the residents both from venting a known carcinogen into breathing space outdoors, and from the indoor risks of fan and/or pipe exhausting dangerous chemicals and carcinogens into the home.
9. The World Health Organization reviewed radon fan discharge locations and made a recommendation consistent with U.S. ANSI/AARST mitigation standards – do not vent the radon system through the side-wall of the building. Instead exhaust the radon up and away from the structure.

   Radon is the largest contributor of radiation exposure for the general public and most of the exposure occurs in the home. It is the deadliest environmental concern in homes today and is responsible for more deaths than drunk driving, fires, and falls combined. Radon exposure should be treated as a severe public health risk and we need to better protect the American public. This proposal does not protect the public. CRCPD and the state and tribal radon programs we represent are strongly against this proposal and believe it should be deleted from the ICC Code in its entirety.

<u>References</u>

Brodhead, B Clarkin, M and Brennan, T 1993 Initial results from follow-up of New Jersey homes mitigated for radon, Proceedings of the 1993 International Radon Symposium), Fletcher, NC: AARST

Radon and Thoron were measured in system exhausts. Levels were found to be very high and may pose a threat to health and safety if not properly vented. Gamma radiation measurements were made on site to compare to average state gamma readings. The post-mitigation gamma radiation was 20% higher than the state gamma average.

Henschel, DB 1995 Re-entrainment and dispersion of exhausts from indoor radon reduction systems: Analysis of tracer gas data, Indoor Air, 5: 270-284

Re-entrainment tests in the field suggest that active soil depressurization systems exhausting at grade level can contribute indoor radon concentrations 3 to 9 times greater than systems exhausting at the eave. With 37,000 Bq/m3 (1,000 pCi/L) in the exhaust, the highest mean concentrations beside the house could be less than or equal to the ambient background level with eave and mid-roof exhausts, and 2 to 7 times greater than ambient with grade exhausts.

Neff, D, Meroney, R and El-Badry, H 1994a Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Final Report). Fort Collins: Fluid Mechanics and Wind Engineering Program, Colorado State University

The objective of this study was to identify whether there are conditions under which the mitigation radon exhaust for typical homes can safely be released at grade level. Results showed the safest exhaust location was above the eave and the at-grade wall release location lead to the highest building surface concentrations.

Neff, D, Meroney, R and El-Badry, H 1994b Physical and Numerical Modeling of ASD Exhaust Dispersion Around Houses (Project Summary; EPA/600/SR-94/115). Research Triangle Park, NC: Air and Energy Engineering Research Laboratory

The tracer gas results show that grade-level exhausts consistently result in the highest tracer concentrations against the face of the house. The highest concentration measured at one point against the side of the house over all runs with grade-level exhaust would correspond to 30 Bq/m3 (0.8 pCi/L) if the exhaust contained 3,700 Bq/m3 (100 pCi/L), and 300 Bq/m3 (8.1 pCi/L) if the exhaust contained 37,000 Bq/m3 (1,000 pCi/L).

Moorman, L 2016 Radon discharge locations that are shown to affect interior radon concentrations negatively, Proceedings of the 2016 International Radon Symposium, Fletcher, NC: AARST

Passive radon mitigation systems installed as RRNC during new home construction were found to have discharge locations close to walls extending vertically above them. Rerouting the vent pipes to bring the discharge location in compliance with current standards lowered the radon levels on multiple floor levels. Paper concludes: “Extra due diligence is required from standard writing in the radon community compared to standard writing for flue gas discharge location. The reason can be summarized by stating that flue exhaust gas is very noticeable and annoying, thus acts as a natural deterrent for the public but radon discharge gas is barely noticeable and thus does not have this deterring effect on the public when present.”

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This proposal requires a radon fan which makes it more expensive.

Public Comment# 1833

RB288-19

IRC®: SECTION AF101, AF101.1, SECTION AF102, AF102.1, , (New), SECTION AF103, AF103.1, AF103.2, FIGURE AF103.2, AF103.3, AF103.3.1 (New), AF103.3.2 (New), AF103.3.3, AF103.4, AF103.4.1, AF103.4.2, AF103.5, AF103.5.1, AF103.5.2, AF103.5.3, AF103.5.4, AF103.5.5, AF103.5.6 (New), AF103.5.6.1, AF103.5.6.2 (New), AF103.5.6.3, AF103.6, AF103.6.1, AF103.6.2, AF103.6.3, AF103.6.4, AF103.6.5, AF103.4.3, AF103.4.6, AF103.4.7, AF103.4.8, AF103.4.9, AF103.11, FIGURE AF101, TABLE AF101(1), ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc. (dave@spruce.com)

2018 International Residential Code

SECTION AF101
SCOPE

Revise as follows:

AF101.1 General. This appendix contains requirements for radon control methods in new construction .~~new construction in *jurisdictions* where radon-resistant construction is required.~~

~~Inclusion of this appendix by jurisdictions shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101 and Table AF101(1)~~

Add new definition as follows:

SECTION AF102
DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

Delete without substitution:

~~**DRAIN TILE LOOP.** A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.~~

Revise as follows:

RADON GAS. ~~A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.~~ The element Rn, which is a radioactive colorless, odorless, tasteless, cancer-causing gas that occurs naturally as a decay product of radium.

Add new definition as follows:

RADON ROUGH-IN. The installation of all parts and materials of sub-membrane or sub-slab depressurization system including gas permeable layers, soil gas retarders, membranes, piping, connectors, terminations, and power sources.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

Revise as follows:

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower submembrane air pressure relative to crawl space air pressure by use of a fan-powered vent drawing air from beneath the soil-gas-retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM ~~(Active).~~ . A system designed to achieve lower ~~subslab~~ sub-slab air pressure ~~relative to indoor air pressure~~ by use of a fan-powered vent drawing air from beneath the slab.

Delete without substitution:

~~**SUBSLAB DEPRESSURIZATION SYSTEM (Passive).** A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the *conditioned space* of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.~~

SECTION AF103
REQUIREMENTS

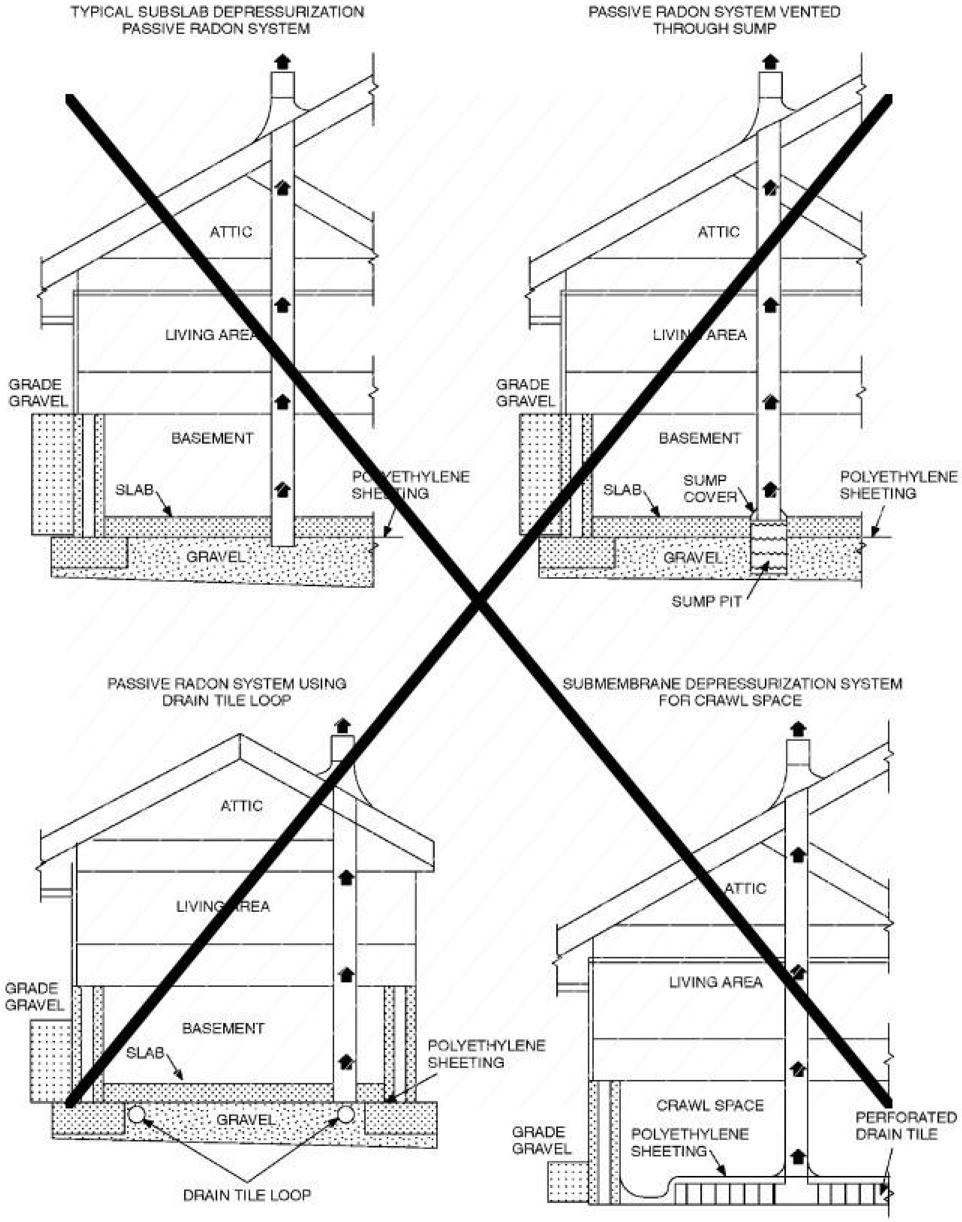
Revise as follows:

AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary ~~(see Figure AF103). These techniques are required in areas where designated by the *jurisdiction*~~ .

AF103.2 ~~**Subfloor preparation.**~~ **Radon Rough-In** A radon rough-in is required for all foundation types, including crawlspace, basement, slab on grade, and slab on grade garage located below a living area as shown in Figure AF103.2. The rough-in shall be installed prior to pouring of concrete slabs, closure of building cavities, and installation of finish materials. ~~layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a subslab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:~~

1. ~~A uniform layer of clean aggregate, not less than 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a $^{1}/_{4}$-inch (6.4 mm) sieve.~~
2. ~~A uniform layer of sand (native or fill), not less than 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.~~
3. ~~Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.~~

Delete and substitute as follows:



~~**FIGURE AF103**~~

~~**RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES**~~

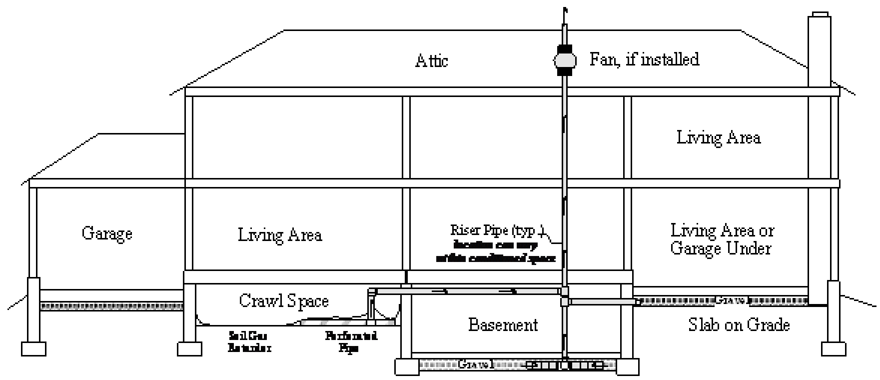


FIGURE AF103.2
FOUNDATION TYPES

Revise as follows:

~~AF103.6~~ AF103.3 ~~Passive subslab~~ Sub-slab depressurization ~~system.~~ system rough-in. In *basement* or slab-on-grade buildings, the following components of a ~~passive subslab~~ sub-slab depressurization system shall be installed during ~~construction.~~ construction in accordance with Sections AF103.3.1 through AF103.3 and AF103.5 through AF103.6.5.

Add new text as follows:

AF103.3.1 Gas Permeable Layer A gas-permeable layer shall be constructed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33.
2. A uniform layer of native or fill sand, a minimum of 4 inches [102 mm] in depth, overlain by a layer or strips of geotextile drainage matting. The geotextile drainage matting shall have a cross-sectional area of at least 12 square inches [774 sq mm]. The closest edge of the geotextile matting shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
3. A loop of 4 inch [102 mm] nominal or larger size perforated pipe placed in a trench along the perimeter of the foundation, with the trench backfilled with clean aggregate having a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33 such that the pipe is surrounded by aggregate for at least 1/3 of the outside pipe circumference. The pipe shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
4. A loop of interconnected stay-in-place forms used to cast the foundation footing in accordance with 404.1.3.3.6 that is left in place to provide ground water control and provide a separate channel above the ground water channel for soil gas ventilation, with a cross sectional area no less than 12 square inches [77 sq. cm].
5. Other materials, systems or floor designs with demonstrated capability to allow the lateral flow of soil gases from across the entire sub-floor area.

AF103.3.2 Vent pipe connector. A 4 inch [102 mm] nominal diameter tee fitting or equivalent method shall be used to secure the vent pipe opening within the gas permeable layer. Not less than 4 feet [1219 mm] of perforated pipe or geotextile matting shall be connected to each of the two horizontal openings of the tee fitting or the two horizontal openings shall be connected to the interior drain tile system. Alternatively, a sealed sump cover where the sump communicates directly with the sub-slab aggregate or communicates with it through a drainage system, shall secure the vent pipe opening. A flexible rubber coupling connector shall be provided at the sump cover connection to facilitate servicing the sump.

Revise as follows:

~~AF103.3~~ AF103.3.3 Soil-gas-retarder. A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly ~~to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly, and to prevent concrete from entering the void spaces in the aggregate base material.~~ . The sheeting shall cover the entire floor area with separate sections of sheeting lapped not less than 12 inches (305 ~~mm). The sheeting shall fit closely around any~~ mm) and extend up the surrounding foundation walls not less than 4 inches [101 mm]. Openings in the sheeting caused by pipe, wire ~~or~~ and other penetrations ~~of the material.~~ shall be sealed. Punctures or tears in the material shall be sealed or covered with additional sheeting.

~~AF103.5~~ AF103.4 ~~Passive submembrane~~ Sub-membrane depressurization ~~system.~~ system rough-in. In buildings with a crawl space ~~foundations~~ foundation, the ~~following~~ components of a ~~passive submembrane~~ sub-membrane depressurization system shall be installed during ~~construction.~~ construction in accordance with Sections AF103.4.1 through AF103.6.5.

Exceptions: ~~Exception:~~

1. Buildings in which an *approved* mechanical crawl space ventilation system ~~or other equivalent system is installed.~~ is installed.
2. Where the soil gas retarder will be covered with concrete, the requirements of Section AF103.3.2 shall apply.

~~AF103.5.3~~ AF103.4.1 Vent ~~pipe.~~ pipe connector. A ~~plumbing~~ tee ~~or other *approved* connection~~ fitting shall be inserted ~~horizontally~~ beneath the ~~sheeting and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.~~ soil gas membrane with not less than 10 feet of perforated pipe connected to each of the two horizontal openings of such fitting or the two horizontal openings of the tee fitting shall connect to the interior drain tile system. The branch opening of the tee fitting shall be connected to the vent pipe in accordance with Section AF103.5.

~~AF103.5.2~~ AF103.4.2 ~~Soil-gas-retarder.~~ Soil gas membrane. The soil in crawl spaces shall be covered with a continuous layer of ~~minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder. The ground cover~~ soil gas membrane complying with ASTM E1745 Class A, B or C. The membrane shall be lapped not less than ~~12~~ 6 inches ~~(305~~ (152 mm) at joints , and shall extend upwards 12 inches (305 mm) and be sealed to all foundation walls enclosing the crawl space area. Seams shall be sealed with polyurethane caulk complying with ASTM C920 class 25 or higher, or taped or equivalent method, installed in accordance with the manufacturer's recommendations.

~~AF103.6.1~~ AF103.5 Vent pipe. A ~~minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent~~ 3 inch [76 mm] nominal size or larger gas-tight pipe shall be ~~embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.~~

~~The pipe shall be extended~~ extended from the tee fitting up through the building floors, in accordance with Sections AF103.5.1 through AF103.5.6. Materials used shall comply with Section P3002.1. ~~and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.~~

AF103.5.1 ~~Ventilation.~~ Vent pipe termination. ~~Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section R408.1.~~

The vent pipe shall terminate vertically upward not less than 12 inches [305 mm] above the roof and in a location not less than two feet [51 mm] vertically above, or not less than 10 feet [3048 mm] measured in any other direction, from openings in the building and adjacent buildings including windows, doors and other gravity air intake openings, exclusive of attic ventilation openings. Where a screen is installed on the terminus of radon exhaust pipe to prevent the entry of animals, such screen shall have a mesh size with a dimension of not less than 0.5 inch (12.7mm).

~~AF103.7~~ AF103.5.2 Vent pipe drainage. ~~Components of the~~ The radon vent pipe ~~system~~ shall be installed to provide ~~positive~~ condensate drainage to the ground beneath the slab or ~~soil-gas-retarder.~~ membrane. The pipe shall not be trapped and shall have a minimum slope of one-eighth inch per foot (1 percent slope).

~~AF103.9~~ AF103.5.3 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one label on each floor and in accessible ~~*attics.*~~ attics. The label shall read ~~: "Radon Reduction System."~~ "This pipe is a component of a radon control system. A radon test is necessary to verify that the radon level is below the level recommended by the US EPA." The height of the label lettering shall be not less than 0.25 inch [6.35 mm].

~~AF103.10~~ AF103.5.4 Combination foundations. ~~Combination *basement*/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected~~ Where more than one type of foundation is present, each foundation area shall have a separate radon vent pipe and soil gas collector. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

~~AF103.6.2~~ AF103.5.5 ~~Multiple vent pipes.~~ Separate foundation areas In buildings where interior footings or other barriers separate ~~the subslab aggregate or other gas-permeable material~~ foundation areas, each area shall be fitted with an individual vent ~~pipe.~~ pipe or a pipe loop or equivalent method shall connect such areas below the slab. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

Add new text as follows:

AF103.5.6 Provisions for radon fan. To facilitate possible installation of a radon fan, compliance with Sections AF103.5.6.1 through AF103.5.6.3 shall be required.

Revise as follows:

~~AF103.8~~ AF103.5.6.1 Vent pipe accessibility. Radon vent pipes shall be ~~accessible for future fan installation through~~ provided with access in an *attic* or other area outside the *habitable space* ~~. **Exception:** The radon vent pipe need not be accessible in an *attic* space where an *approved* roof-top electrical supply is provided~~
for the purpose of installing a fan.The pipe shall be centered in an an unobstructed cylindrical space having a vertical height of not less than 48 inches [122 cm] and a diameter of not less than 21 inches [53 cm] in the location where a fan would be installed.

Exception: Where an *approved* electrical supply is installed on the roof for future use.

Add new text as follows:

AF103.5.6.2 Radon fan location. Fans shall be located outdoors, in attics or in garages that are not beneath conditioned spaces. Fans shall not be installed below ground, in conditioned spaces, in occupiable spaces of a building or in any basement, crawlspace or other interior location that is directly beneath a conditioned or occupiable space of a building. Fans shall not be installed in any location where pipe positively pressured by the fan would be located inside conditioned or occupiable space.

Revise as follows:

~~AF103.12~~ AF103.5.6.3 Power source. To provide for future installation of ~~an active submembrane or subslab depressurization system~~ a radon fan, an electrical circuit ~~terminated~~ that terminates in an *approved* junction box shall be installed ~~during construction~~ in the *attic* or other anticipated location of ~~vent pipe fans. An electrical supply shall be accessible in anticipated locations of system failure alarms.~~ a fan.

~~AF103.4~~ AF103.6 Entry routes. Potential radon entry routes shall be closed in accordance with Sections ~~AF103.4.1~~ AF103.6.1 through ~~AF103.4.10.~~ AF103.6.5.

~~AF103.4.1~~ AF103.6.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires ~~or~~ and other objects that penetrate concrete slabs ~~,~~ or ~~other~~ floor assemblies ~~,~~ shall be ~~filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.~~ sealed in a permanent manner.
Exception: Sealing is not required for floors above conditioned spaces.

~~AF103.4.2~~ AF103.6.2 Concrete joints. ~~Control~~ Isolation joints, ~~isolation joints,~~ construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk ~~or other elastomeric sealant applied~~ complying with ASTM C920 class 25 or higher or equivalent method installed in accordance with the manufacturer's recommendations.

~~AF103.4.4~~ AF103.6.3 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

~~AF103.4.5~~ AF103.6.4 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent the passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks ~~or~~ and other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk complying with ASTM C920 class 25 or ~~equivalent sealant.~~ higher, or equivalent method installed in accordance with the manufacturer's recommendations. Penetrations of concrete walls shall be filled.

~~AF103.4.10~~ AF103.6.5 Crawl space access. Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.
Exception: Air sealing is not required for conditioned crawl spaces.

Delete without substitution:

~~**AF103.4.3 Condensate drains.** Condensate drains shall be trapped or routed through nonperforated pipe to daylight.~~

~~**AF103.4.6 Dampproofing.** The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.~~

~~**AF103.4.7 Air-handling units.** Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.~~

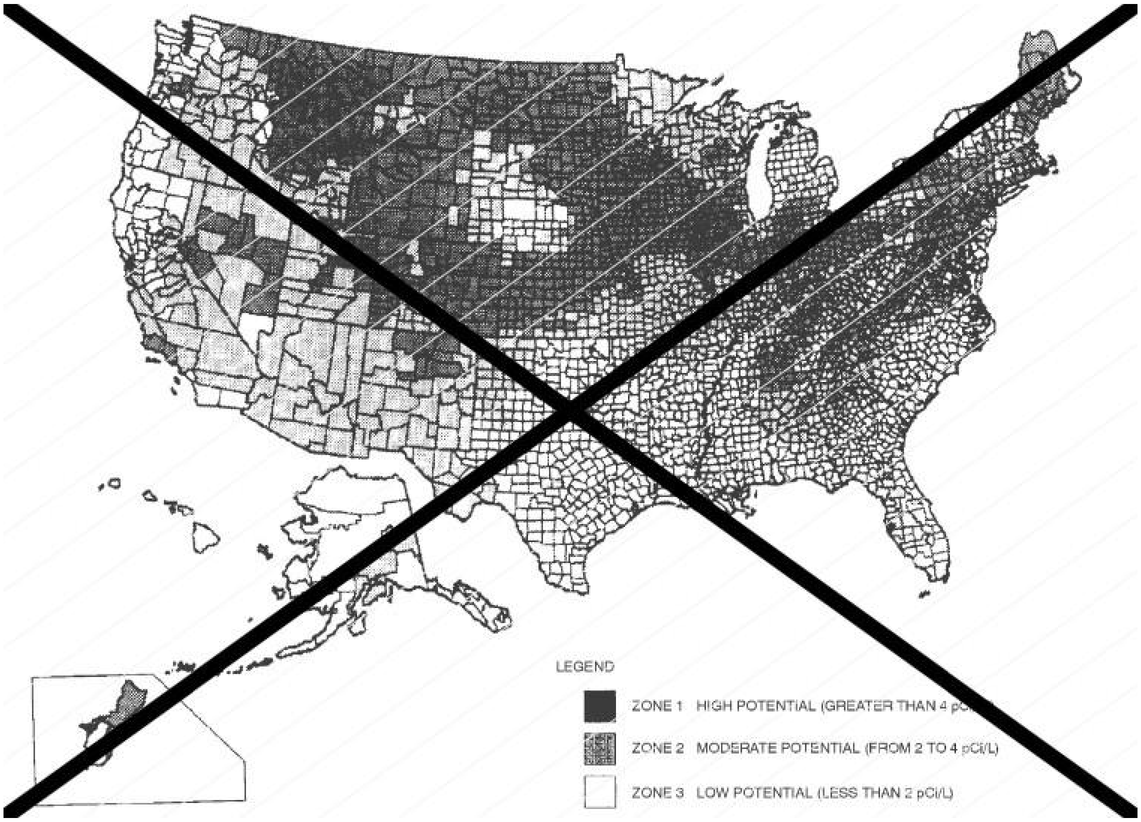
~~**Exception:** Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.~~

~~**AF103.4.8 Ducts.** Ductwork passing through or beneath a slab shall be of seamless material unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.~~

~~Ductwork located in crawl spaces shall have seams and joints sealed by closure systems in accordance with Section M1601.4.1.~~

~~**AF103.4.9 Crawl space floors.** Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.~~

~~**AF103.11 Building depressurization.** Joints in air ducts and plenums in un*conditioned spaces* shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.~~



~~a.pCi/L standard for picocuries per liter of radon gas. The U.S. Environmental Protection Agency (EPA) recommends that homes that measure 4 pCi/L and greater be mitigated.~~

~~The EPA and the U.S. Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist *building officials* in deciding whether radonresistant features are applicable in new construction.~~

~~The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon-control methods. The radon zone designation of highest priority is Zone 1. Table AF101 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-402-R-93-021 through 070) available through State Radon Offices or from EPA Regional Offices.~~

~~FIGURE AF101~~
~~EPA MAP OF RADON ZONES~~

~~TABLE AF101(1)~~
~~HIGH RADON-POTENTIAL (ZONE 1) COUNTIES[a]~~

Delete table in its entirety

~~a.The EPA recommends that this county listing be supplemented with other available State and local data to further understand the radon potential of a Zone 1 area.~~

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1745: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

Reason: This code change proposal improves Appendix F by clarifying some construction details, resolving longstanding editorial issues and addressing a few significant installation problems that impact the effectiveness of radon control in new construction.
The requirement subsections are renumbered to facilitate deletions of redundant material and reorganization. The narrative statement below refers to the subsection numbers in the *proposed* text.

- Additional detail has been provided on the vent pipe connector in Section AF103.3.3, the connection between the vertical radon vent pipe and the gas permeable layer below the crawl space or slab. This connection has suffered from consistent clogging with soil, concrete and/or gravel. A requirement for a couple of short lengths of perforated piping in the gas permeable layer and clarification that the tee fitting shall secure the vent pipe will largely prevent this clogging.
- Another latent problem which occurs often in the field is that the vent piping is routed through the attic space without allowing access to the vent pipe and leaving insufficient headroom for a fan if system activation is required. Space considerations are provided to address this problem in Section AF103.5.6. Fan installation remains outside of the scope of AF103.5.6.
- Section AF103.4.1, the required 12-inch lapping of joints is reduced to 6 inches, and extension of the soil gas retarder upward on foundation walls for subslabs is added to match the extension on walls for crawl spaces.
- Clearances to prevent radon entry from the exhaust pipe are clarified, and prevention of pipe obstruction by screening material is added, both within Section AF03.5.1.
- In Section AF103.5.3, the vent pipe identification is expanded to clarify the limit of Appendix F radon control.
- Lack of sealing of the submembrane soil gas retarder creates problems in systems installed in homes with crawl spaces. In this proposal, sealing is added (except for where the crawl space will be covered by concrete and where crawl space ventilation exists) to

Several editorial changes clarify and simplify the Appendix without expanding requirements. Along with some fairly self-explanatory edits, these changes include:

- Section AF101 specifies that the scope of the appendix is “radon control methods in new construction.”
- Section AF101 would no longer include references to EPA radon zone 1, zone 1 county lists, or the EPA radon map. Voluntary use of the Appendix by builders and adoptions in jurisdictions beyond Zone 1 reduce the applicability of these materials. According to the Home Innovations Research Lab report “Radon-Resistant Construction Practices in New U.S. Homes 2016” [see bibliography] 24% of 2016 homes in Zone 2 were built with radon control. In 2016 the State of Connecticut adopted radon control for all counties; previously Minnesota and Illinois did the same. Local jurisdictions are adopting the Appendix.
- In AF102, the definition of radon gas is simplified, a universal term, radon rough-in, is added to clarify the type of system allowed by Appendix F, and duplicative references to active and passive subslab methods are deleted in favor of a single definition for subslab systems.
- In Section AF103.3.1 Gas Permeable Layer, an option for using stay-in-place forms per 404.1.3.3.6 is added to the choices, and the specification allowing for “the lateral flow of gases” is moved from the initial sentence to the fifth and final option.

- The description of materials for vent pipes in Section AF103.5 was changed from “ABS, PVC or equivalent” to “comply with P3002.1.”
- Redundancies with other code requirements for ventilation, foundation and condensate drains, damp proofing, and air handler sealing have been removed.
- An exception for sealing for floors above conditioned spaces is added in AF 103.6.1.
- Sealing requirements for control joints were eliminated in AF 103.6.2.

Most of the changes in this proposal were presented by the proponent in code change proposal or public comment in 2016.

Below for ease of review is the text that would result from the proposed revisions:

APPENDIX F

RADON CONTROL METHODS
AF101.1 General. This appendix contains requirements for radon control methods in new construction.

SECTION AF102 DEFINITIONS
AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:
RADON GAS. The element Rn-222, which is a radioactive, colorless, odorless, tasteless, cancer-causing gas that occurs naturally as a decay product of radium.
RADON ROUGH-IN. The installation of all parts and materials of submembrane or subslab depressurization system including gas permeable layers, soil gas retarders, membranes, piping, connectors, terminations, and power sources.
SOIL-GAS-RETARDER. A continuous membrane of 6-mil [0.15 mm] polyethylene or other equivalent material used to retard the flow of soil gases into a building.
SUBMEMBRANE DEPRESSURIZATION SYSTEM. System designed to achieve lower sub-membrane air pressure relative to crawl space air pressure by use of a fan powered vent drawing air from beneath the soil gas retarder membrane.
SUBSLAB DEPRESSURIZATION SYSTEM. System designed to achieve lower sub-slab air pressure by use of a fan-powered vent drawing air from beneath the floor slab.

SECTION AF103 REQUIREMENTS
AF103.1 General. AF103 is intended to reduce radon entry and prepare the building for post-construction radon mitigation if necessary.
AF103.2 Radon Rough-in. A rough-in is required for all foundation types, including crawlspace, basement, slab on grade, and slab on grade garage located below a living area as shown in Figure AF103.2. The rough-in shall be installed prior to pouring of concrete slabs, closure of building cavities, and installation of finish materials.
Figure AF103.2 Foundation Types
AF103.3 Sub-slab depressurization system rough-in. In basement or slab-on-grade buildings, the components of a sub-slab depressurization system shall be installed during construction in accordance with AF103.3.1 through AF103.3 and AF103.5 through AF103.6.5.
AF103.3.1 Gas permeable layer. A gas-permeable layer shall be constructed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building. The gas-permeable layer shall consist of one of the following:
A uniform layer of clean aggregate, not less than 4 inches [102 mm] in depth, shall be placed over the soil. The aggregate shall have a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33.
A uniform layer of native or fill sand, a minimum of 4 inches [102 mm] in depth, overlain by a layer or strips of geotextile drainage matting. The geotextile drainage matting shall have a cross-sectional area of at least 12 square inches [774 sq mm]. The closest edge of the geotextile matting shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
A loop of 4 inch [102 mm] nominal or larger size perforated pipe placed in a trench along the perimeter of the foundation, with the trench backfilled with clean aggregate having a void ratio of not less than 35 percent or a Size Number 4, 5, 56, or 6 as classified by ASTM C33 such that the pipe is surrounded by aggregate for at least 1/3 of the outside pipe circumference. The pipe shall be placed no closer than 12 inches [305 mm] to the foundation wall around the interior of the foundation perimeter.
A loop of interconnected stay-in-place forms used to cast the foundation footing in accordance with 404.1.3.3.6 that is left in place to provide ground water control and provide a separate channel above the ground water channel for soil gas ventilation, with a cross sectional area no less than 12 square inches [77 sq. cm].
Other materials, systems or floor designs with demonstrated capability to allow the lateral flow of soil gases from across the entire sub-floor area.
AF103.3.2 Vent pipe connector. A 4 inch [102 mm] nominal diameter tee fitting or equivalent method shall be used to secure the vent pipe opening within the gas permeable layer. Not less than 4 feet [1219 mm] of perforated pipe or geotextile matting shall be connected to each of the two horizontal openings of the tee fitting or the two horizontal openings shall be connected to the interior drain tile system. Alternatively, a sealed sump cover where the sump communicates directly with the sub-slab aggregate or communicates with it through a drainage system, shall secure the vent pipe opening. A flexible rubber coupling connector shall be provided at the sump cover connection to facilitate servicing the sump.
AF103.3.3 Soil gas retarder. A minimum 6-mil [[.006 in; 0.15 mm] (or 3-mil [[.003 in; 0.075 mm] cross-laminated) polyethylene or equivalent flexible sheeting material shall be placed on top of the gas permeable layer prior to casting the slab or placing the floor assembly. The sheeting shall cover the entire floor area with separate sections of sheeting lapped not less than 12 inches [305 mm] and extend up the surrounding foundation walls not less than 4 inches [101 mm]. Openings in the sheeting caused by pipe, wire and other penetrations shall be sealed. Punctures or tears in the material shall be sealed or covered with additional sheeting. AF103.4 Sub-membrane depressurization system rough-in. In buildings with a crawl space foundation, the components of a sub-membrane depressurization system shall be installed during construction in accordance with AF103.4.1

through AF103.6.5.   `
Exceptions:
Buildings in which an approved mechanical crawl space ventilation system is installed.
Where the soil gas retarder will be covered with concrete, the requirements of 103.3.2 shall apply.
AF103.4.1 Vent pipe connector. A tee fitting shall be installed beneath the soil gas membrane with not less than 10 feet of perforated pipe connected to each of the two horizontal openings of such fitting or the two horizontal openings of the tee fitting shall connect to the interior drain tile system. The branch opening of the tee fitting shall be connected to the vent pipe in accordance with section AF103.5.
AF103.4.2 Soil gas membrane. The soil in crawl spaces shall be covered with a continuous layer of soil gas membrane complying with ASTM E1745 Class A, B or C. The membrane shall be lapped not less than 6 inches [152 mm] at joints and shall extend upwards 12 inches [305 mm] and be sealed to all foundation walls enclosing the crawl space area. Seams shall be sealed with polyurethane caulk complying with ASTM C920 class 25 or higher, or taped or equivalent method, installed in accordance with the manufacturer's recommendations.
AF103.5 Vent pipe. A 3 inch [76 mm] nominal size or larger gas-tight pipe shall be extended from the tee fitting up through the building floors and in accordance with Sections AF103.5.1 through AF103.5.6. Materials used shall comply with P3002.1.
AF103.5.1 Vent pipe termination. The vent pipe shall terminate vertically upward not less than 12 inches [305 mm] above the roof and in a location not less than two feet [51 mm] vertically above, or not less than 10 feet [3048 mm] measured in any other direction from, openings in the building and adjacent buildings including windows, doors and other gravity air intake openings, exclusive of attic ventilation openings. Where a screen is installed on the terminus of radon exhaust pipe to prevent the entry of animals, such screen shall have a mesh size with a dimension of not less than 0.5 inch (12.7mm).
AF103.5.2 Vent pipe drainage. The radon vent pipe shall be installed to provide condensate drainage to the ground beneath the slab or membrane. The pipe shall not be trapped and shall have a minimum slope of one-eighth inch per foot (1 percent slope).
AF103.5.3 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one label on each floor and in accessible attics. The label shall read “This pipe is a component of a radon control system. A radon test is necessary to verify that the radon level is below the level recommended by the US EPA..” The height of the label lettering shall be not less than 0.25 inch [6.35 mm].
AF103.5.4 Combination foundations. Where more than one type of foundation is present, each foundation area shall have a separate radon vent pipe and soil gas collector. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.
AF103.5.5 Separate foundation areas. In buildings where interior footings or other barriers separate foundation areas, each area shall be fitted with an individual vent pipe or a pipe loop or equivalent method shall connect such areas below the slab. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.
AF103.5.6 Provisions for radon fan. To facilitate possible installation of a radon fan, the following shall be provided:
AF103.5.6.1 Vent pipe accessibility. The radon vent pipes shall be provided with access in an attic or other area outside the habitable space for the purpose of installing a fan. The pipe shall be centered in an unobstructed cylindrical space having a vertical height of not less than 48 inches [122 cm] and a diameter of not less than 21 inches [53 cm] in the location where a fan would be installed.
Exception: Where an approved electrical supply is installed on the roof for future use.
AF103.5.6.2 Radon fan location. Fans shall be located outdoors, in attics or in garages that are not beneath conditioned spaces. Fans shall not be installed below ground, in conditioned spaces, in occupiable spaces of a building or in any basement, crawlspace or other interior location that is directly beneath a conditioned or occupiable space of a building. Fans shall not be installed in any location where pipe positively pressured by the fan would be located inside conditioned or occupiable space.
AF103.5.6.3 Power source. To provide for future installation of a radon fan, an electrical circuit that terminates in an approved junction box shall be installed in the attic or other anticipated location of a fan.
AF103.6 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.6.1 through AF103.6.5.
AF103.6.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires and other objects that penetrate concrete slabs or floor assemblies shall be sealed in a permanent manner.
Exception: Sealing is not required for floors above conditioned spaces.
AF103.6.2 Concrete joints. Isolation joints, construction joints and other joints in concrete slabs and between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk complying with ASTM C920 class 25 or higher or equivalent method installed in accordance with the manufacturer's recommendations.
AF103.6.3 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as a suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.
AF103.6.4 Foundation walls. Hollow block masonry foundation walls shall be constructed with a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished grade to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks and other openings around penetrations of both exterior and interior surfaces of masonry block and wood foundation walls below the ground surface shall be filled with polyurethane caulk complying with ASTM C920 class 25 or higher, or equivalent method installed in accordance with the manufacturer's recommendations. Penetrations of concrete walls shall be sealed.
AF103.6.5 Crawl space access. Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.
Exception: Air sealing is not required for conditioned crawl spaces.

Bibliography: “Radon-Resistant Construction Practices in New U.S. Homes 2016,” prepared by Home Innovations Research Lab, Annual Builder Practices Survey, 5960-17, for USEPA.

ASTM E1745

Cost Impact: The code change proposal will increase the cost of construction
The additional cost of the code change in materials is $25: $10 for 10 feet of 4" perforated pipe; $10 for caulk to seal the soil gas retarder and $5 in additional cost for soil retarder material on walls (offset by the reduction in soil retarder material neded to overlap seams). There is also a labor cost component which is minimal for the perforated pipe and varable for the sealing depending on the area of the crawl space.
Installation of the existing Appendix F in a single family home is documented in the Home Innovation Research Labs' 2016 report on radon-resistant construction practices [see bibliography]: "In 2016, the average installation cost for a passive system in a single-family detached home was approximately $374, up slightly from the $358 reported for 2015 and $332 reported for 2014."

Staff Analysis: A review of the standard proposed for inclusion in the code, ASTM E1745, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB288-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee does not want to remove the map and is not in favor of the language in AF101.1. That struck language gave departments guidance on when to deal with Zone 1 requirements. The map is a key component, especially when jurisdictions are considering adoption of the appendix. AF103.5.6.2 being added would conflict with previous action. (Vote: 11-0)

Assembly Action: **None**

RB288-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jane Malone, American Association of Radon Scientists and Technologists, representing American Association of Radon Scientists and Technologists (jmalone@aarst.org)

requests As Submitted

Commenter's Reason: The reasons stated in the code change proposal remain relevant.
Additional statement in response to the reported committee reason for disapproval:
All over the US, builders are installing radon control systems in counties classified as Zone 1, 2 and 3. In 2016, 24% of Zone 2 homes had radon systems installed. Radon systems outside of Zone 1 should be subject to code official oversight for compliance with Appendix F. The methods apply regardless of radon zone.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The additional cost of the code change in materials is $25: $10 for 10 feet of 4" perforated pipe; $10 for caulk to seal the soil gas retarder and $5 in additional cost for soil retarder material on walls (offset by the reduction in soil retarder material needed to overlap seams). There is also a labor cost component which is minimal for the perforated pipe and variable for the sealing depending on the area of the crawl space.

Public Comment# 1972

RB289-19

IRC®: AF104 (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Residential Code

Add new text as follows:

AF104 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen
5. Testing shall be performed with a commercially available radon test kit or with a continuous radon monitor that can be calibrated. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing device manufacturer's instructions
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for at least 12 hours prior to the testing
7. .Testing shall be performed by the builder, a registered design professional, or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer, whichever is longer
9. .Written radon test results shall be provided by the test lab or testing party. The final written test results shall be included with construction documents.
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.8 and AF103.12
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

Reason: Testing is the only way to know if radon levels are below the safety level. Radon is a tasteless colorless gas that can cause lung cancer. Radon tests are relatively simple and inexpensive. The jurisdiction decides if radon-resistant construction applies in the jurisdiction by adopting (or not adopting) Appendix F, most commonly adopting the Appendix F in radon zone 1. Both the occupants and the builder want to know that the radon mitigation system works.

Where radon systems are required, consider this test commissioning for the radon system. Typically the inexpensive radon test kits are mailed off to a testing lab. The testing lab responds fairly quickly with written results. The “safety” level or range is a test below 4 pCi/L. Besides confirming compliance, written test results provide the owner with confirmation the home’s radon level is at or below the safety level. For unsold homes, written test results with the construction documents allow the future owner to know that the home passed its safety test.

Often homes will pass without installing the fan described in Appendix F, with is sometimes called a “passive” radon system. Where a passive system does not meet the safety level, adding a fan usually lowers the radon level to the safety range.

Bibliography: The American Cancer Society states that “The leading cause of lung cancer in non-smokers is exposure to radon gas.” (ref 1) The link between radon and lung cancer has been firmly established for about 20 years (ref 2). Radon is estimated to cause about 20,000 deaths per year from lung cancer (ref 2). Children exposed to high levels of radon are more likely to develop lung cancer later in life. (ref 3). Deaths from radon significantly exceed deaths from other building-related risks; such as fires, falls, electrocution, tornadoes, hurricanes, winds, fires, etc. In part this is because the codes have reduced these other risks, but have not addressed radon as well.

1) Lung Cancer Risks for Non-Smokers. American Cancer Society. Nov 6, 2017 https://www.cancer.org/latest-news/why-lung-cancer-strikes-nonsmokers.html
Radon “accounts for about 21,000 deaths from lung cancer each year.”

2) U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation. 1999.
https://www.nap.edu/read/5499/chapter/1#viii https://www.nap.edu/read/5499/chapter/5#97
Historically the link between radon and lung cancer was not understood. Radon is an invisible, tasteless and odorless gas. There is a long period between exposure to radon and the symptoms of lung cancer. Recognition that radon increased lung cancers came from early studies of uranium miners, and was later confirmed more broadly.
https://www.nap.edu/read/5499/chapter/5#97

In 1999 it was concluded that residential radon, as well as smoking, were the most important contributors to the lung cancer. Note table 3-10, summed "total male" and "total female" for both "ever-smokers" and "never-smokers" Actual value in table is 21,800, but is rounded to 21,000.

3) "Canadian Lung Cancer Relative Risk from Radon Exposure for Short Periods in Childhood Compared to a Lifetime" International Journal of Environmental Research and Public Health. 2013 May; 10(5): 1916–1926.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3709356/
The study concluded: "*... exposure to radon during childhood increases the lifetime risk of developing lung cancer ... if a child lived in a home with very high radon concentration for only a few years, the risk of developing lung cancer later in the life could be equivalent to a lifetime exposure to moderate radon concentration.*"

Cost Impact: The code change proposal will increase the cost of construction
Radon test kits are inexpensive, less than $50 for the two tests including laboratory determination of results. Tests by radon professionals will likely be more expensive.

RB289-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Continuous radon monitor testing must be maintained, but this is lacking. There are concerns regarding test kits from retailers. We usually have a standard for a test. The result should not go to the building official. That said, the committee feels the proponent is onto something and should continue this work and submit a public comment. (Vote: 7-4)

Assembly Action: **None**

RB289-19

Individual Consideration Agenda

Public Comment 1:

IRC®: AF104 (New)

Proponents:
Craig Conner, representing self (craig.conner@mac.com); David Kapturowski, representing AARST & Spruce Environmental Technologies, Inc.; Ruth Mcburney, representing Conference of Radiation Control Program Directors (rmcburney@crcpd.org); Aaron S Johnson, US EPA, representing US EPA (johnson.aarons@epa.gov); Janise Stoliarova, representing USEPA (stoliarova.janise@epa.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AF104 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen
5. Testing shall be performed with a commercially available radon test kit or testing shall be performed by an approved third party with a continuous radon monitor ~~that can be calibrated~~. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit ~~device~~ manufacturer's instructions
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for at least 12 hours prior to the testing
7. Testing shall be performed by the builder, a registered design professional, or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less that the period specified by the testing device manufacturer,

whichever is longer

9. Written radon test results shall be provided by the test lab or testing party. The final written test ~~results~~ report with results less than 4 pCi/L shall be ~~included with construction documents~~ provided to the code official.
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.8 and AF103.12
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

Commenter's Reason:
All who testified against the original proposed change are co-proponents of this public comment. This comment incorporates the results of discussions both at and after the hearing. The committee suggested a public comment.

Radon systems need to be tested. Nobody can see, hear, taste, or feel radon. Soil under residences can contain high levels of radon. Construction specified in Appendix F is intended to limit radon entering the residence, but testing is the only way to know if a radon system works. Testing functions as commissioning for radon systems.

This comment clarifies the radon testing language. The comment clarifies that test kit instructions are in addition to the requirements of the section. In practice most will test using radon test kits; however, radon professionals may choose to use continuous radon monitors. Both types of testing are allowed.

This comment specifies a report showing radon results below EPA's "action level" (4 PCi/l). If initial test results shows a high radon level, items #10 and #11 require modifications and retesting to achieve the lower radon level. Modifications include activating the vent fan described in the existing Appendix F.

Please approve this public comment to add a radon test to verify radon systems work.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Radon test kits are inexpensive, less than $50 for the two tests including laboratory determination of results.

Public Comment# 1440

RB291-19

IRC®: AK102.1, AK103.1, ASTM Chapter 44 (New)

Proposed Change as Submitted

Proponents: Tim Earl, representing The Gypsum Association (tearl@gbhinternational.com)

2018 International Residential Code

Revise as follows:

AK102.1 General. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a sound transmission class (STC) rating of 45 where tested in accordance with ASTM E90 or an apparent STC (ASTC) of 42 when tested in accordance with ASTM ~~E90.~~ E336. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. *Dwelling unit* entrance doors, which share a common space, shall be tight fitting to the frame and sill.

AK103.1 General. Floor/ceiling assemblies between *dwelling units*, or between a *dwelling unit* and a public or service area within a structure, shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM ~~E492.~~ E492 or an apparent IIC (AIIC) of 42 where tested in accordance with ASTM E1007.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E336-17a: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1007-16: Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

Reason: This creates the addition of the option for field testing for ASTC and AIIC – actual field measures versus laboratory measures - with slightly lower requirements for these versus the lab tested assemblies as they are actual numbers of in place systems. This begins to migrate the code to the more preferred field verified apparent measures as reflected in ICC G2-2010 guidance, in the IBC and in ASTM standards on sound, but still leaves it as just an option in an optional appendix.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This adds an optional method of testing, so it will not increase the cost of construction unless users choose this option, which would add approximately $1,500 to the cost of a home.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM E336-17a and E1007-16, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB291-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: A public comment to address the proposed modification may be in order. (Vote: 11-0)

Assembly Action: **None**

RB291-19

Individual Consideration Agenda

Public Comment 1:

IRC®: AK102.1, AK103.1, ASTM Chapter 44 (New)

Proponents:
Samantha Rawlings, representing Veneklasen Associates (srawlings@veneklasen.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AK102.1 General. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a sound transmission class (STC) rating of 45 where tested in accordance with ASTM E90 or a Normalized Noise Isolation Class (NNIC) rating ~~an apparent STC (ASTC)~~ of 42 when tested in accordance with ASTM E336. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. *Dwelling unit* entrance doors, which share a common space, shall be tight fitting to the frame and sill.

AK103.1 General. Floor/ceiling assemblies between *dwelling units*, or between a *dwelling unit* and a public or service area within a structure, shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492 or a Normalized Impact Sound Rating (NISR) ~~an apparent IIC (AIIC)~~ of 42 where tested in accordance with ASTM E1007.

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E336-17a: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

E1007-16: Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

Commenter's Reason: The proposed change adds references to the correct field test standards and mirrors the IBC language to maintain consistency between the codes.
This change was proposed at the committee action hearings but the modification was ruled out-of-order. The committee expressed support of the floor modification and suggested proponents resubmit as a public comment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed change only clarifies code requirements and maintains consistency with the IBC code language. There is no cost impact.

Public Comment# 1848

RB292-19

IRC®: AQ (New), AQ106.1 (New), AQ106.1.1 (New), AQ107.1 (New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Residential Code

Add new text as follows:

AQ
Energy Conservation

AQ106.1 Testing for tiny houses. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 pascals of pressure per ft^2 of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official.* Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope.*

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate not exceeding 0.30 cfm per ft^2 of the dwelling unit enclosure area in accordance with Section AQ106.1 is provided, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ107.1 Tiny House. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.
4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section R404.
6. Mechanical ventilation is provided in accordance with Section M1505 of this code. Operable fenestration is not used for ventilation.

Reason: The appendix currently states that tiny houses must comply with the code except for the following. There are some energy requirements that need to be adjusted for the unique construction of tiny houses. The current test parameters for air tightness are not conducive for houses with smaller volumes. The new testing parameters and metrics will provide the ability for air leakage of the smaller structures and allowing for them to demonstrate compliance.
When testing to the new metrics there needs to be an understanding that when meeting the testing one must provide a whole house mechanical ventilation system.

This proposal addresses those tiny houses that build to be self-sufficient with their energy consumption. If they meet those requirements they should be considered to comply with the intent of the energy requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
These requirements while are already required would not increase the cost of construction. This proposal provide options for the type of construction that happens for tiny houses to obtain energy compliance.

RB292-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Modified**

Committee Modification:

SECTION AQ106
Energy Conservation

AQ106.1 ~~Testing for tiny houses~~ Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 ~~pascals~~ Pascals of pressure per ft^2 of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.

2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.

3. Interior doors, if installed at the time of the test, shall be open.

4. Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.

5. Heating and cooling systems, if installed at the time of the test, shall be turned off.

6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate not exceeding 0.30 cfm per ft^2 of the dwelling unit enclosure area in accordance with Section AQ106.1 is provided, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

~~AQ107.1 Tiny House~~ AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2

2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.

3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.

4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.

5. Permanently installed lighting is in accordance with Section R404.

6. Mechanical ventilation is provided in accordance with Section M1505 of this code. Operable fenestration is not used for ventilation.

Committee Reason: Compliance with the code is required with the exception of what is in the appendix. This helps to regulate tiny house construction. The titles in the modification make much more sense. (Vote: 10-1)

Assembly Action: **None**

RB292-19

Individual Consideration Agenda

Public Comment 1:

IRC®: SECTION AQ106 (New), AQ106.1 (New), AQ106.1.1 (New), AQ106.2 (New)

Proponents:

Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Thom Stanton, representing Tiny Home Industry Association (THIA) (gotiny.com@gmail.com); Brad Wiseman, representing Tiny Home Industry Association (chairman@tinyhomeindustryassociation.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

SECTION AQ106
Energy Conservation

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft^2 of the dwelling unit enclosure area. The dwelling unit enclosure area shall be the sum of the areas of ceilings, floors, and walls that separate the conditioned space of a dwelling unit from the exterior, its adjacent unconditioned spaces, and adjacent dwelling units.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior ~~doors~~ or interior terminations for continuous ventilation systems ~~and heat recovery ventilators~~ shall be ~~closed and~~ sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where ~~an~~ the air leakage rate ~~not exceeding 0.30 cfm per ft² of the dwelling unit enclosure area~~ is in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.
4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section ~~R404~~ N1104.
6. Mechanical ventilation is provided in accordance with Section M1505 ~~of this code. Operable~~ and operable fenestration is not used ~~for~~ to meet ventilation requirements.

Commenter's Reason: This public comment does the following:

- Defines "dwelling unit enclosure area", which was absent. Uses language consistent with the source definition from ASHRAE 62.2-2016, and editorial changes to definitions of this term in public comments to proposals RE88 and RE92.
- Corrects item 4 under "During testing:" in Section AQ106.1, which was from the 2015 IRC, not the 2018 IRC

- Simplifies and reduces the language in Section AQ106.1.1 without changing its meaning
- Replaces IECC number R404 in Section AQ106.2 item 5 with the more appropriate IRC section number N1104 (the content of these sections is identical)
- Simplifies and clarifies the language in item 6 in Section AQ106.2

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The requirements in the proposal are already required in the IRC and would not increase the cost of construction. The proposal, along with the modifications in the public comment, simply provides options for tiny houses to meet those requirements and obtain energy compliance.

Public Comment# 1617

Public Comment 2:

IRC®: SECTION AQ106 (New), AQ106.1 (New), AQ106.1.1 (New), AQ106.2 (New)

Proponents:
Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT (strawnet@gmail.com); Brad Wiseman, representing Tiny Home Industry Association (chairman@tinyhomeindustryassociation.org); Thom Stanton, representing Tiny Home Industry Association (THIA) (gotiny.com@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

SECTION AQ106
Energy Conservation

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft^2 of the dwelling unit enclosure area.<u> The air leakage testing shall be in accordance with the testing methods required in</u> <u>Section N1102.4.1.2</u><u>. The dwelling unit enclosure area shall be the sum of the areas of ceilings, floors, and walls that separate the conditioned space of a dwelling unit from the exterior, its adjacent unconditioned spaces, and adjacent dwelling units.</u> ~~Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.~~

~~During testing:~~

1. ~~Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.~~
2. ~~Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.~~
3. ~~Interior doors, if installed at the time of the test, shall be open.~~
4. ~~Exterior doors for continuous ventilation systems and heat recovery ventilators shall be closed and sealed.~~
5. ~~Heating and cooling systems, if installed at the time of the test, shall be turned off.~~
6. ~~Supply and return registers, if installed at the time of the test, shall be fully open.~~

AQ106.1.1 Whole house mechanical ventilation. Where ~~an~~<u> the</u> air leakage rate ~~not exceeding 0.30 cfm per ft^2 of the dwelling unit enclosure area~~ <u>is</u> in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *International Energy Conservation Code* provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy use for the structure.

4. Solar, wind, or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section ~~R404~~ N1104.
6. Mechanical ventilation is provided in accordance with Section M1505 ~~of this code. Operable~~ and operable fenestration is not used ~~for~~ to meet ventilation requirements.

Commenter's Reason: This public comment:

- Defines "dwelling unit enclosure area", which was absent. Uses language consistent with the source definition from ASHRAE 62.2-2016, and editorial changes to definitions of this term in public comments to proposals RE88 and RE92.
- Removes language that is duplicated verbatim in IRC Section N1102.4.1.2, and instead references that section
- Simplifies and reduces the language in Section AQ106.1.1 without changing its meaning
- Replaces IECC number R404 in Section AQ106.2 item 5 with the more appropriate IRC section number N1104 (the content of these sections is identical)
- Simplifies and clarifies the language in item 6 in Section AQ106.2

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The requirements in the proposal are already required in the IRC and would not increase the cost of construction. The proposal, along with the modifications in the public comment, simply provides options for tiny houses to meet those requirements and obtain energy compliance.

Public Comment# 1939

Public Comment 3:

IRC®: AQ106.1 (New), AQ106.1.1 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cfm at 50 Pascals of pressure per ft^2 of the dwelling unit enclosure area.

Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather stripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open.
4. Exterior or interior terminations ~~doors~~ for continuous ventilation systems ~~and heat recovery ventilators~~ shall be ~~closed and~~ sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

AQ106.1.1 Whole house mechanical ventilation. Where an air leakage rate ~~not exceeding~~ is 0.30 cfm per ft^2 of the dwelling unit enclosure area or less in accordance with Section AQ106.1 ~~is provided~~, the tiny house shall be provided with whole house mechanical ventilation in accordance with Section M1505.4.

Commenter's Reason: the public comment is to address a couple of items that came to my attention. Number 4 of the During testing portion of

AQ106.1 utilized the 2015 wording and not the 2018 wording, which is what my original intent was for this proposal. The original wording of AQ106.1.1 felt a bit awkward, so I corrected it.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
These items were already required.

Public Comment# 2052

RB299-19

IRC®: APPENDIX U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), AU101.3 (New), AU101.4 (New), FIGURE AU101.4 (New), SECTION AU102 (New), AU102.1 (New), SECTION AU103 (New), AU103.1 (New), AU103.2 (New), AU103.3 (New), AU103.4 (New), AU103.4.1 (New), AU103.5 (New), AU103.6 (New), AU103.7 (New), AU103.8 (New), AU103.9 (New), SECTION AU104 (New), AU104.1 (New), AU104.2 (New), AU104.3 (New), AU104.4 (New), AU104.4.1 (New), AU104.4.2 (New), AU104.4.3 (New), AU104.4.3.1 (New), AU104.4.3.2 (New), AU104.4.4 (New), AU104.4.5 (New), AU104.4.6 (New), AU104.4.7 (New), AU104.4.8 (New), AU104.4.9 (New), SECTION AU105 (New), AU105.1 (New), AU105.2 (New), AU105.3 (New), AU105.3.1 (New), TABLE AU105.3 (New), AU105.3.2 (New), AU105.3.3 (New), AU105.3.4 (New), AU105.3.4.1 (New), AU105.3.4.2 (New), AU105.3.4.3 (New), AU105.3.5 (New), AU105.4 (New), AU105.4.1 (New), AU105.4.2 (New), AU105.4.3 (New), AU105.4.4 (New), AU105.4.5 (New), AU105.5 (New), SECTION AU106 (New), AU106.1 (New), AU106.2 (New), AU106.3 (New), AU106.4 (New), AU106.5 (New), AU106.6 (New), AU106.6.1 (New), AU106.7 (New), AU106.7.1 (New), AU106.8 (New), AU106.8.1 (New), AU106.8.2 (New), AU106.9 (New), AU106.9.1 (New), AU106.9.1.1 (New), AU106.9.1.2 (New), AU106.9.1.3 (New), AU106.9.2 (New), AU106.9.3 (New), AU106.9.4 (New), AU106.9.5 (New), AU106.9.6 (New), AU106.10 (New), TABLE AU106.10 (New), AU106.11 (New), AU106.11.1 (New), AU106.11.2 (New), AU106.11.3 (New), FIGURE AU106.11.3 (New), TABLE AU106.11(1) (New), TABLE AU106.11(2) (New), TABLE AU106.11(3A) (New), AU106.11(3B) (New), AU106.11(3C) (New), AU106.12 (New), TABLE AU106.12 (New), AU106.13 (New), AU106.14 (New), SECTION AU107 (New), AU107.1 (New), SECTION AU108 (New), AU108.1 (New), AU108.2 (New), SECTION AU109 (New), AU109.1 (New), AU109.2 (New), AU109.3 (New), SECTION AU110 (New)

Proposed Change as Submitted

Proponents: Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); john fordice, representing cob research institute (otherfish@comcast.net); Michael Smith, representing Cob Research Institute (michael@strawclaywood.com); Art Ludwig, representing Oasis Design (art@oasisdesign.net); David Eisenberg, representing DCAT (strawnet@gmail.com); Anthony Dente, representing Verdant Structural Engineers (anthony@verdantstructural.com); David Rich, Reax Engineering Inc., representing Reax Engineering Inc. (rich@reaxengineering.com); Kevin Donahue, representing Kevin Donahue Structural Engineer (kevin@verdantstructural.com); Ben Loescher, representing Self (bloescher@lmarchitectsinc.com)

2018 International Residential Code

Add new text as follows:

APPENDIX U
Cob Construction (Monolithic Adobe)

SECTION AU101
GENERAL

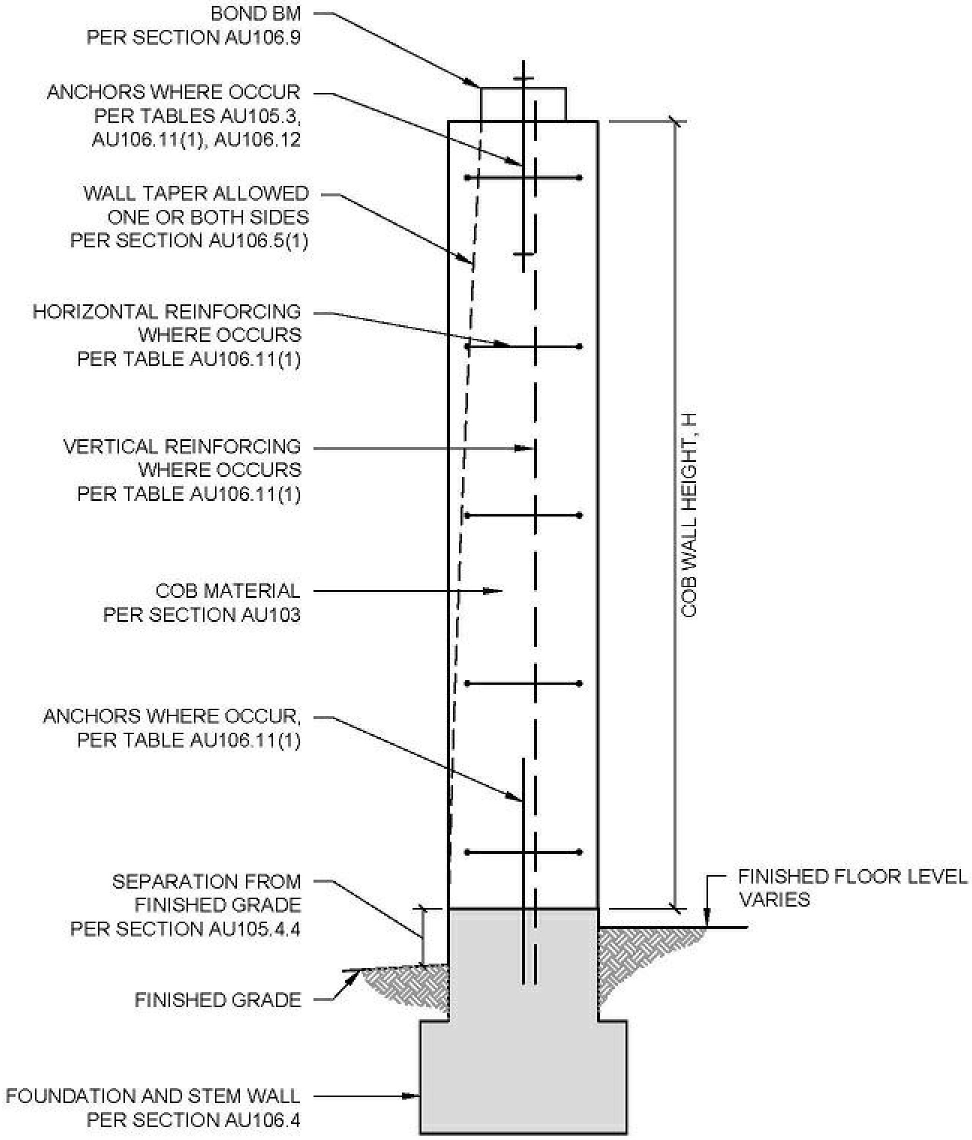
AU101.1 Scope. This appendix provides prescriptive and performance-based requirements for the use of *natural cob* as a building material. *Buildings* using *cob* walls shall comply with this code except as otherwise stated in this appendix.

AU101.2 Intent. In addition to the intent described in Section R101.3, the purpose of this appendix is to establish minimum requirements for cob structures that provide flexibility in the application of certain provisions of the code, to permit the use of site-sourced and local materials, and innovative combinations of proven historical and modern techniques that are safe, reduce life-cycle impacts, and increase affordability.

AU101.3 Tests and empirical evidence. Tests for an alternative material, design or method of construction shall be in accordance with Section R104.11.1, and the *building official* shall have the authority to consider evidence of a history of successful use in lieu of testing.

AU101.4 Cob wall systems. *Cob* wall systems include those shown in Figure AU101.4 and *approved* variations.

FIGURE AU101.4 TYPICAL COB WALL



SECTION AU102
DEFINITIONS

AU102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of the *International Residential Code* for general definitions.

BRACED WALL PANEL. A *cob* wall designed and constructed to resist in-plane shear loads through the interaction of the cob material, its reinforcing and its connections to its bond beam and foundation. The panel's length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AU106.11 and R602.10.1.

BUTTRESS. A mass set at an angle to, or bonded to a wall that it strengthens or supports.

CLAY. Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in a mix of *cob* or of *clay* plaster.

CLAY SUBSOIL. Subsoil sourced directly from the earth, containing *clay*, sand, and silt, and not more than trace amounts of organic matter.

COB. A composite building material consisting of refined clay or clay subsoil wet-mixed with loose straw and sometimes sand. Also known as *monolithic adobe*.

COB CONSTRUCTION. A wall system of layers or *lifts* of moist *cob* placed to create monolithic walls, typically without formwork.

DRY JOINT. The boundary between a layer of moist cob and a previously laid and significantly drier, non-malleable layer of cob that requires wetting to achieve bonding between the layers.

FINISH. Completed combination of materials on the face of a *cob* wall.

LIFT. A layer of installed *cob*.

LOAD-BEARING WALL. A *cob* wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.

MONOLITHIC ADOBE. Synonymous with *cob*.

NATURAL COB. Cob not containing admixtures such as Portland cement, lime, asphalt emulsion, or oil. Synonymous with *unstabilized* cob.

NONSTRUCTURAL WALL. Walls other than *load-bearing* walls or *shear walls*.

PLASTER. C*lay*, soil-cement, gypsum, lime, clay-lime, cement-lime, or cement plaster as described in Section AU104.

SHEAR WALL. A *cob* wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AU106.11. Synonymous with *braced wall panel*.

STABILIZED. *Cob* or other earthen material containing admixtures such as Portland cement, lime, asphalt emulsion, or oil, that are intended to help limit water absorption, stabilize volume, increase strength, and increase durability.

STRUCTURAL WALL. A wall that meets the definition for a *load-bearing* wall or *shear wall*.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

UNSTABILIZED. A *Cob* or other earthen material that does not contain admixtures such as Portland cement, lime, asphalt emulsion, or oil.

SECTION AU103
MATERIALS, MIXING, AND INSTALLATION

AU103.1 Clay subsoil. *Clay subsoil* for a *cob* mix shall be acceptable if the mix it produces meets the requirements of Section AU103.4.

AU103.2 Sand. Sand or other aggregates such as, but not limited to, gravel, pumice and lava rock, when added to *cob* mixes, shall yield a mix that meets the requirements of Section AU103.4.

AU103.3 Straw. *Straw* for *cob* mixes shall be from wheat, rice, rye, barley or oat, or similar reinforcing fibers with similar performance. Before mixing, the straw or other reinforcing fibers shall be dry to the touch and free of visible decay.

AU103.4 Mix proportions. *Cob* mixes shall be of any proportion of refined *clay* or *clay subsoil*, added sand (if any) and straw that produces a dried mix that passes the shrinkage test in accordance with Section AU103.4.1, complies with the compressive strength requirements of Section AU106.6 and complies with the modulus of rupture requirements of Section AU106.7.

AU103.4.1 Shrinkage test for cob mixes. Each proposed *cob* mix of different mix proportions shall be placed moist to completely fill a 24-inch by 3 1/2-inch by 3 1/2-inch (610 mm by 89 mm by 89 mm) wooden form on a plastic or paper slip sheet and dried to ambient moisture conditions, or oven dried. The total shrinkage of the length shall not exceed 1 inch (25 mm), as measured from the dried edges of the material to the insides of the form. Cracks in the sample > 1/16 inch (1.5 mm) shall first be closed manually. The shrinkage test shall be shown to the building official for approval before placement of the cob mix onto walls.

AU103.5 Mixing. The clay subsoil, sand and straw for *cob* shall be thoroughly mixed by manual or mechanical means with water sufficient to produce a mix of a plastic consistency capable of bonding of successively placed layers or *lifts*.

AU103.6 Installation. *Cob* shall be installed on the wall in *lifts* of a height that supports itself with minimal slumping.

AU103.7 Dry joints. Each layer of cob shall be prevented from drying until the next layer is installed, to ensure bonding of successive layers. The top of each layer shall be kept moist and malleable with one or more of the following methods:

1. Covering with a material that prevents loss of or holds moisture,
2. Covering with a material that shades it from direct sun, or
3. Wetting.

When dry joints are unavoidable, the previous layer shall be wetted prior to application of the next layer.

AU103.8 Drying holes. Where holes to facilitate drying are used, such holes shall be of any depth and not exceeding 3/4-inch (19 mm) in diameter on the face of *cob* walls. Drying holes shall not be spaced closer than ten hole-diameters. Drying holes shall not be placed in *braced wall panels*. The design load on load-bearing walls with drying holes shall not exceed 90% of the allowable bearing capacity as determined in accordance with Section AU106.8. Drying holes shall be filled with cob before final inspection.

AU103.9 Adding roof loads to walls. Roof and ceiling loads shall not be added until walls are sufficiently dry to support them without compressing.

SECTION AU104
FINISHES

AU104.1 General. *Cob* walls shall not require a *finish*, except as required by Section AU104.2. Finishes applied to *cob* walls shall be plasters in accordance with Section AU104.4, non-plaster exterior wall coverings in accordance with Section R703 or other finish systems in accordance with the following:

1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.
3. Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m^2) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.
4. Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m^2) of wall area shall require an engineered design.

AU104.2 Where required. Cob walls exposed to rain due to local climate, building design and wall orientation shall be finished or clad to provide protection from excessive erosion.

AU104.3 Vapor retarders. Class I and II vapor retarders shall not be used on *cob* walls, except at cob walls surrounding showers or as required or addressed elsewhere in this appendix.

AU104.4 Plaster. *Plaster* applied to *cob* walls shall be any type described in this section. *Plaster* thickness shall not exceed 3 inches (76 mm) on each face except where an approved engineered design is provided.

AU104.4.1 Plaster and membranes. *Plaster* shall be applied directly to *cob* walls to facilitate transpiration of moisture from the walls and to secure a mechanical bond between the *plaster* and the *cob*. A membrane shall not be located between the cob wall and the plaster.

AU104.4.2 Plaster lath. The surface of *cob* walls shall be permitted to function as lath for plaster, with no other lath required. Metal, plastic, and natural fiber lath shall be permitted to be used to limit plaster cracking or increase the plaster bond to the wall, or to bridge dissimilar materials.

AU104.4.3 Clay plaster. *Clay* plaster shall comply with Sections AU104.4.3.1 and AU104.4.3.2.

AU104.4.3.1 General. *Clay* plaster shall be any plaster having a *clay* or *clay subsoil* binder. Such plaster shall contain sufficient clay to fully bind the sand or other aggregate and any reinforcing fibers. Reinforcing fibers shall be chopped straw, sisal, hemp, animal hair or other similar *approved* fibers.

AU104.4.3.2 Clay subsoil requirements. The suitability of *clay subsoil* shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

AU104.4.4 Soil-cement plaster. Soil-cement plaster shall be composed of *clay subsoil*, sand, not more than 7 percent Portland cement by volume and, where provided, reinforcing fibers.

AU104.4.5 Gypsum plaster. Gypsum plaster shall comply with Section R702.2.1 and shall be limited to interior use.

AU104.4.6 Lime plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

AU104.4.7 Clay-lime plaster. Clay-lime plaster shall be composed of refined *clay* or *clay subsoil*, sand, lime and, where provided, reinforcing fibers.

AU104.4.8 Cement-lime plaster. Cement-lime plaster shall be plaster mix types CL, F or FL, as described in ASTM C926.

AU104.4.9 Cement plaster. Cement plaster shall have not less than 1 part lime to 4 parts cement and be not thicker than 1-1/2 inches (38 mm), to ensure minimum acceptable vapor permeability

SECTION AU105
COB WALLS—GENERAL

AU105.1 General. *Cob walls* shall be designed and constructed in accordance with this section and Figure AU101.4 or an *approved* alternative design. In addition to the general requirements for c*ob* walls in this section, c*ob structural walls* shall comply with Section AU106.

AU105.2 Building limitations and requirements for cob wall construction. *Cob* walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one.
2. *Building* height: not more than 25 feet (7620 mm).
3. Seismic design categories: limited to use in Seismic Design Categories A, B and C, except where an *approved* engineered design is provided.
4. Wall height: in accordance with Table AU105.4, and with Table AU106.11(1) for *braced wall panels*.
5. Wall thickness, excluding finish, shall be not less than 10 inches, not greater than 24 inches at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2(2). Wall taper is permitted in accordance with Section AU106.5(1).
6. Interior *cob* walls shall require an *approved* engineered design that accounts for the seismic load of the interior *cob* walls, except in Seismic Design Category A for walls with a height to thickness ratio ≤ to 6.

AU105.3 Out-of-plane resistance methods and unrestrained wall height limits. *Cob* walls shall employ a method of out-of-plane load resistance in accordance with Table AU105.3, and comply with its associated height limits and requirements.

AU105.3.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AU105.3 shall be in accordance with the ultimate design wind speed and seismic design category requirements of Sections R301.2.1 and R301.2.2 respectively. An *approved* engineered design shall be required where the building is located in a Special Wind Region or a Wind Design Required location in accordance with Figure R301.2(5)B.

TABLE AU105.3 OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS

WALL TYPE[a, g, h] and METHOD OF OUT-OF-PLANE LOAD RESISTANCE	**FOR ULTIMATE DESIGN WIND SPEEDS (mph)**	**FOR SEISMIC DESIGN CATEGORIES**	**UNRESTRAINED COB WALL HEIGHT H[b, c]**		**TOP ANCHOR[e] SPACING (inches)**	**TENSION TIE[f] SPACING (inches)**
			Absolute limit in feet	**Limit based on wall thickness T[d] in feet**		
Wall 1[i]: no anchors, no steel wall reinforcing	≤ 110	A	$H \le 8$	$H \le 6T$	none	48
Wall 2: top anchors[j], continuous vertical 6”x6”x6 gage steel mesh in center of wall embedded in foundation 12”	≤ 140	A, B, C	$H \le 8$	$H \le 8T$	12	24
Wall A[i]: top anchors, no vertical steel reinforcing	≤ 120	A, B	$H \le 8$	$H \le 6T$	12	48
Wall B[i]: top & bottom anchors, no vertical steel reinforcing	≤ 130	A, B	$H \le 8$	$H \le 6T$	12	48
Wall C: top and bottom anchors, continuous vertical threaded rod at 4’ oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \le 8$	$H \le 8T$	12	24
Wall D: continuous vertical threaded rod at 1’ oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \le 8$	$H \le 8T$	NA	24
Wall E: top anchors, continuous vertical 6”x6”x6 gage steel mesh 2” from each face of wall embedded in foundation	≤ 140	A, B, C	$H \le 8$	$H \le 8T$	12	24

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

N/A = Not Applicable

a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall types A, B, C, D and E.

b. *H* = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.

c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an *approved* engineered design.

d. *T* = Cob wall thickness (in feet) at its minimum, without plaster.

e. 5/8-inch threaded rod anchors at prescribed spacing with 12” embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.

f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure R608.9(9). Where rafters are attached to tension ties shall, roof sheathing shall be edge nailed.

g. All walls shall be tested for compressive strength in accordance with Section AU106.6.

h. For curved walls with an arc length:radius ratio of 1.5:1 or greater, the H/T factor shall be increased by 1, and the absolute height limit by 1 foot.

i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.

j. See wall type A in Table AU106.11(1) for top anchor requirements.

AU105.3.2 Bond beams for nonstructural walls. Nonstructural *cob* walls shall be provided with a bond beam at the top of the wall that complies with Section AU106.9, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.

AU105.3.3 Lintels in nonstructural walls. Door, window, and other openings in nonstructural *cob* walls shall require a lintel in accordance with Section AU106.10, except for requirements relating to roof and/or ceiling loads or *braced wall panels*.

AU105.3.4 Reinforcing at wall openings. Reinforcing shall be installed at window, door, and similar wall openings and penetrations greater than 2 feet (610 mm) in width in accordance with this section. Surface voids deeper than 25 percent of the wall thickness shall be considered an opening.

AU105.3.4.1 Opening size limit. Openings shall not exceed 6 feet (1829 mm) in width, and the height of the cob wall below openings shall not exceed 6 feet (1829 mm) above the top of the foundation.

AU105.3.4.2 Horizontal reinforcing. 2-inch by 2-inch (51 mm by 51 mm) 14 gage galvanized steel mesh shall be embedded 4 inches (102 mm) in the cob above the rough opening and below the rough opening for windows, and shall extend 12 inches (305 mm) beyond the sides of the opening. Walls below rough window openings greater than 4 foot 6 inches (1372 mm) in height shall be provided with additional horizontal reinforcing at mid-height.

AU105.3.4.3 Vertical reinforcing. Full-height 5/8-inch (16 mm) threaded rod shall be installed 4 inches (102 mm) from each side of the opening, centered in the thickness of the cob wall. The threaded rods shall be embedded 7 inches (178 mm) in the foundation, and 4 inches (102 mm) in concrete bond beams or shall penetrate through wood bond beams and be secured with a nut and washer. The threaded rods shall be embedded in concrete lintels, or pass through a drilled hole in wood lintels.

AU105.3.5 Minimum length of cob walls. Sections of *cob* walls between openings shall be not less than 2 foot 6 inches (762 mm) in length. Wall sections less than 4 feet (1219 mm) and not less than 2 foot 6 inches (762 mm) in length shall contain vertical reinforcing in accordance with Section AU105.3.4.3

AU105.4 Moisture control. *Cob* walls shall be protected from moisture intrusion and damage in accordance with Sections AU105.4.1 through AU105.4.5.

AU105.4.1 Water-resistant barriers and vapor permeance. *Cob* walls shall be constructed without a membrane barrier between the *cob* wall and *plaster* to facilitate transpiration of water vapor from the wall, and to secure a mechanical bond between the cob and plaster, except as otherwise required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior finish, it shall be considered part of the finish system and shall comply with Section AU104.1(2) for the combined vapor permeance rating.

AU105.4.2 Horizontal surfaces. *Cob* walls and other *cob* elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent erosion and prevent water from entering the wall system. Horizontal surfaces, including exterior window sills, sills at exterior niches, and exterior buttresses, shall be sloped not less than 1 unit vertical in 12 units horizontal to drain away from *cob* walls or other cob elements.

AU105.4.3 Separation of cob and foundation. A liquid-applied or bituminous Class II *vapor retarder* shall be installed between *cob* and supporting concrete or masonry

Exception: Where local climate, site conditions and foundation design limit ground moisture migration into the base of the *cob* wall, including but not limited to the use of a moisture barrier or capillary break between the supporting concrete or masonry and the earth.

AU105.4.4 Separation of cob and finished grade. *Cob* shall be not less than 8 inches (203 mm) above finished grade.

Exception: The minimum separation shall be 4 inches (102 mm) in Dry climate zones as defined in Table N1101.7.2(1) [R302.3(1)], and shall be 2 inches (51mm) on walls that are not weather-exposed.

AU105.4.5 Installation of windows and doors. Windows and doors shall be installed in accordance with the manufacturer's instructions to a wooden frame of not less than nominal 2x4 (51 mm by 102 mm) wood members anchored into the cob wall with 16d galvanized nails half-driven at a maximum 6-inch (152 mm) spacing, with the protruding half embedded in the cob. The wood frame shall be embedded not less than 1-1/2 inches (38 mm) in the cob and shall be set in from each face of the wall not less than 3 inches (76 mm). Alternative window and door installation methods shall be capable of resisting the wind loads in Table R301.2(2). Windows and doors in cob walls shall be installed so as to mitigate the passage of air or moisture into or through the wall system. Window sills shall comply with Section AU105.4.2.

AU105.5 Inspections. The *building official* shall inspect the following aspects of *cob construction* in addition to the required tests of, and accordance with Section R109.1:

1. Anchors and vertical and horizontal reinforcing in *cob* walls, where required in accordance with Tables AU105.2 and AU106.11(1) and Sections AU105.3.4 and AU105.3.5.
2. Reinforcing in any concrete bond beams or lintels, in accordance with Sections AU106.9.2 and Table AU106.10.

SECTION AU106
COB WALLS—STRUCTURAL

AU106.1 General. *Cob structural walls* shall be in accordance with the prescriptive provisions of this section. Designs or portions of designs not complying with this section shall require an *approved* engineered design.

AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, *cob structural walls* shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
2. Wall thickness: shall be in accordance with Section AU105.2(5) and Section AU106.8.1 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
3. *Braced wall panel* lengths: for *buildings* using *cob braced wall panels*, the greater of the values determined in accordance with Tables AU106.11(2) for wind loads and AU106.11(3) for seismic loads shall be used.

AU106.3 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301, except that the dead load for *cob* walls shall be determined with the following equation:

$CW_{DL} = (H \times T_{avg} \times D)$ **(Equation AU-1)**

where:

CW_{DL} = Cob wall dead load (in pounds per lineal foot of wall)

H = Height of cob portion of wall (in feet)

T_{avg} = Average thickness of wall (in feet)

D = Density of cob = 110 (in pcf), unless a lesser value at equilibrium moisture content is demonstrated to the *building official*

AU106.4 Foundations. Foundations for *cob* walls shall be in accordance with Chapter 4. The width of foundations for cob walls shall be not less than the width of the cob at its base, excluding *finish.*

AU106.5 Wall taper, straightness and surface voids for cob walls. *Cob* walls shall be in accordance with the following:

1. *Cob structural* and *nonstructural walls* shall be vertical, or shall taper from bottom to top with the wall thickness in accordance with Section AU105.2(5) and the wall height in accordance with AU105.2(4).
2. *Cob structural* and *nonstructural walls* shall be straight or curved. Curved *braced wall panels* shall be in accordance with Sections AU106.11.2 and AU106.11.3.
3. Niches and other surface voids in *load-bearing walls* are limited to 12 inches (305 mm) in width and height and 25 percent of the wall thickness, and shall be located in the top two-thirds of the wall. Surface voids that exceed these limits shall be considered wall openings, and shall receive a lintel in accordance with Section AU106.10 and be reinforced in accordance with Section AU105.3.4. Surface voids are prohibited in *braced wall panels*.

AU106.6 Compressive strength of cob structural and nonstructural walls. All *cob* walls shall have a minimum compressive strength of 60 psi (414 kPa). *Cob* in walls used as *braced wall panels* shall have a minimum compressive strength of 85 psi (586 kPa).

AU106.6.1 Demonstration of compressive strength. The compressive strength of the *cob* mix to be used in *structural walls* and *nonstructural walls* as required in Section AU106.6 shall be demonstrated to the *building official* before the placement of cob onto walls, with compressive strength tests and an associated report by an *approved* laboratory or with an *approved* on-site test as follows:

1. Five samples of the proposed *cob* mix shall be placed moist to completely fill a 4-inch by 4-inch by 4-inch (102 mm by 102 mm by 102 mm) form and dried to ambient moisture conditions. Samples shall not be oven dried. Any opposite faces shall be faced with plaster of Paris if needed to achieve smooth, parallel faces, after which the sample shall reach ambient moisture conditions before testing. The horizontal cross-section of the dried sample as tested, and the maximum applied load at failure shall be used to calculate the sample's compressive strength. The fourth lowest value shall be used to determine the mix's compressive strength.

AU106.7 Modulus of rupture of cob structural walls. *Cob* in walls used as *braced wall panels* shall have a minimum modulus of rupture of 50 psi (345 kPa).

AU106.7.1 Demonstration of modulus of rupture. The modulus of rupture of *cob* used in structural walls as required in Section AU106.7 shall be demonstrated to the *building official* before the placement of cob onto walls, with modulus of rupture tests and an associated report by an *approved* laboratory or with an *approved* on-site test as follows:

1. Five samples of the proposed *cob* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm by 152 mm by 305 mm) form and dried to indoor ambient moisture conditions. Samples shall not be oven dried. Each sample shall be tested with the 12-inch (305 mm) dimension horizontal. The fourth lowest value shall be used to determine if the mix's meets the minimum required modulus of rupture.

AU106.8 Bearing capacity. The allowable bearing capacity for *cob load-bearing walls* supporting vertical roof and/or ceiling loads imposed in accordance with Section R301 shall be determined with the following equation:

$BC = (C \times T_{min})/3 - (H \times T_{avg} \times D)$ **(Equation AU-2)**

where:

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall)

C = Compressive strength (in psi) as determined in accordance with Section AU106.6

T_{min} = Thickness of wall (in feet) at its minimum

H = Height of cob portion of wall (in feet)

T_{avg} = Average thickness of wall (in feet)

D = Density of cob = 110 (in pcf), unless a lesser value at equilibrium moisture content is demonstrated

AU106.8.1 Support of uniform loads. Uniform roof and/or ceiling loads shall be supported by *cob load-bearing walls* not exceeding their allowable bearing capacity, as demonstrated in accordance with the following equation:

$BL \leq BC$ **(Equation AU-3)**

where:

BL = Design load on the wall (in pounds per lineal foot) determined in accordance with Sections R301.4 and R301.6

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall) determined in accordance with Section AU106.8

AU106.8.2 Support of concentrated loads. Concentrated roof and/or ceiling loads shall be distributed by structural elements capable of distributing the loads to the *cob load-bearing wall* and within its allowable bearing capacity as determined in accordance with Section AU106.8. Concentrated loads over lintels or over bond beams spanning openings shall require an *approved* engineered design.

AU106.9 Bond beams. *Cob structural walls* shall require a bond beam at the top of the wall in accordance with Sections AU106.9.1, AU106.9.2 or AU106.9.3, and shall be anchored to the *cob* below in accordance with Tables AU105.3, AU106.11(1) and AU106.12 as applicable and most restrictive. Bond beams spanning openings shall be in accordance with Section AU106.9.4.

AU106.9.1 Wood bond beams. Wood bond beams shall be not less than nominal 4 inches high by 8 inches wide and shall comply with Sections AU106.9.1.1 through AU106.9.1.3.

AU106.9.1.1 Wood species and grade. Wood bond beams shall be of a species with an extreme fiber in bending (F_b) of not less than 850 psi (5.9 MPa), a modulus of elasticity (*E*) of not less than 1,300,000 psi (8964 MPa), and of No. 2 grade or better. Composite lumber bond beams shall have an extreme fiber in bending (F_b) of not less than 850 psi (5.9 MPa), and a modulus of elasticity (*E*) of not less than 1,300,000 psi (8964 MPa).

AU106.9.1.2 Discontinuity. Discontinuous wood bond beams shall be spliced on top with a metal strap with not less than the allowable wind or seismic load tension capacity in accordance with the following, whichever is more restrictive:

1. For seismic design categories: A: 2500 pounds (11 kN). B: 4500 pounds (20 kN). C: 6000 pounds (26.7 kN).
2. For braced wall line lengths, when wind governs: 10 feet: 2500 pounds (11 kN). 20 feet: 3400 pounds (15.1 kN). 30 feet: 5000 pounds (22.2 kN).

AU106.9.1.3 Corners and curved walls. Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined in in accordance Section AU106.9.2.

AU106.9.2 Concrete bond beams. Concrete bond beams shall be not less than 6 inches (152 mm) high by 8 inches (305 mm) wide. Concrete bond beams shall be reinforced with two # 4 bars, 2 inches (51 mm) clear from the bottom and 2 inches (51 mm) clear from the sides. Lap splices shall comply with Table R608.5.4(1). Reinforcing at corners shall be in accordance with the horizontal reinforcing requirements in Section R608.6.4. The concrete shall have a compressive strength of not less than 2500 psi (17.2 MPa) at 28 days.

AU106.9.3 Other bond beams. Bond beams of other materials, including earthen materials, require an *approved* engineered design.

AU106.9.4 Bond beams spanning openings. Bond beams that support uniform roof and/or ceiling loads and span openings in *cob* walls shall be in accordance with Table AU106.10. Bond beams shall be continuous across the opening and not less than 1 foot (305 mm) beyond each side of the opening.

AU106.9.5 Connection of roof framing to bond beams. Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2, 6, 30, 31, and 32. Tension ties shall be provided in accordance with Figure R608.9(9) and Footnote f of Table AU105.3. 10d toe nails at 6 inches (152 mm) on center shall be provided from the rim blocking to top plate for the entirety of braced wall lines, instead of the 43 mil strap shown in Figure R608.9(9). A nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with 5/8-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and toe nailing of rim blocking.

AU106.9.6 Bond beams at gable and shed roof end walls. Bond beams at end walls of buildings with gable or shed roofs shall comply with the following:

1.End walls shall not exceed 20 feet (6096 mm) in length.
2.Shall be continuous and straight for the entire wall line.
3.Wood bond beams when used shall comply with the following:
3.1.Not less than nominal 4x8 (102 mm by 203 mm) when wind design governs in accordance with Tables AU106.11(2) and AU106.11(3), and for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category A, and for wall lengths ≤ 10 feet (3048 mm) in Seismic Design Categories B and C.
3.2.Not less than nominal 4x10 (102 mm by 254 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category B.
3.3.Not less than nominal 6x12 (152 mm by 305 mm) or 4x16 (102 mm by 406 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category C.
4.Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B, and C and for ultimate design wind speeds ≤ 140 mph (63.6 m/s).
5.Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602.

AU106.10 Lintels. Door, window, and other openings in *load-bearing cob* walls shall be provided with a lintel of wood or concrete in accordance with Table AU106.10.

TABLE AU106.10 LINTELS AND BOND BEAMS SPANNING OPENINGS

• GROUND SNOW LOAD ≤ 30 PSF			WOOD: F_b ≥ 850 PSI E ≥ 1,300,000 PSI NO. 2 GRADE OR BETTER ORIENTED FLAT 1 PIECE OR 2 EQUAL-WIDTH PIECES EXTEND 1 FT BEYOND OPENING SIDES		CONCRETE: 2500 PSI COMPRESSIVE STRENGTH HEIGHT = 6” EXTEND 1 FT BEYOND OPENING SIDES REINFORCEMENT: 2 - #4 BARS[a] 2” CLEAR FROM BOTTOM 2” CLEAR FROM SIDES[a]	
Building width (feet)	**Cob above lintel (feet)**	**Total cob wall and plaster thickness (inches)**	**SIZE OF WOOD LINTEL OR BOND BEAM H x W (nominal inches)**		**WIDTH OF CONCRETE LINTEL OR BOND BEAM (inches)**	
			For Span ≤ 4’	**For Span ≤ 6’**	**For Span ≤ 6’**	**For Span ≤ 8’**
10	0	≤ 27	4x8	4x8	8	8
10	1	15	4x12	4x12	12	12
10	1	19	4x16	4x16	16	16
10	1	27	4x24	4x24	24	24
10	2	15	4x12	6x12	12	12
10	2	19	4x16	6x16	16	16
10	2	27	4x24	4x24	24	24
20	0	≤ 27	4x8	6x8	8	8
20	1	15	4x12	6x12	12	12

20	1	19	4x16	6x16	16	16
20	1	27	4x24	4x24	24	24
20	2	15	4x12	6x12	12	NP
20	2	19	4x16	6x16	16	NP
20	2	27	4x24	6x24	24	NP
30	0	≤ 27	4x8	6x8	8	NP
30	1	15	4x12	6x12	12	NP
30	1	19	4x16	6x16	16	NP
30	1	27	4x24	6x24	24	NP
30	2	15	4x12	6x12	12	NP
30	2	19	4x16	6x16	16	NP
30	2	27	4x24	6x24	24	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

NP = Not Permitted

a. Concrete bond beams spanning openings, and lintels greater than 16 inches in width, shall have an additional #4 bar in the center of their width.

AU106.11 Cob braced wall panels. *Cob braced wall panels* shall be in accordance with Section R602.10 and Tables AU106.11(1), AU106.11(2) and AU106.11(3A), AU106.11(3B) and AU106.11(3C). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An *approved* engineered design shall be required in accordance with Section R301.2.1 where the building is located in a Special Wind Region or a Wind Design Required location in accordance with Figure R301.2(5)B.

AU106.11.1 Non-orthogonal braced wall panels. *Braced wall panels* at an angle to the orthogonal braced wall lines shall be considered to contribute to the minimum total braced wall lengths in Tables AU106.11(2) and AU106.11(3) as follows:

1. A braced wall panel not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50% of its length to that line.
2. A braced wall panel not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A braced wall panel greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved braced wall panel to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two braced wall lines in two orthogonal directions. The spacing of the braced wall lines for wind design in Table AU106.11(2) and the spacing and length of the braced wall lines for seismic design in Table AU106.11(3), shall be the maximum widths of the building in the two orthogonal directions.

AU106.11.3 Radius, thickness and length of curved braced wall panels. *Cob* curved *braced wall panels* shall have an inside radius of not less than 5 feet (1524 mm), shall be of the thickness required in Table AU106.11(1) and of the length determined in accordance with Section AU106.11. The curved wall's length shall be considered to be the length of the arc at the center of the wall, in accordance with Figure AU106.11.3 and determined with the following equation:

$ARC_C = .0175\ R_C \times A$ **(Equation AU-4)**

where:

ARC_C = Length of arc at center of wall (in feet)

R_C = Radius at center of wall = $R_I + .5T$ (in feet)

R_I = Inside radius of wall (in feet)

T = Thickness of wall without finish (in feet)

A = Angle of extent of braced wall panel from the center of the arc (in degrees)

FIGURE AU106.11.3 CURVED BRACED WALL PANEL

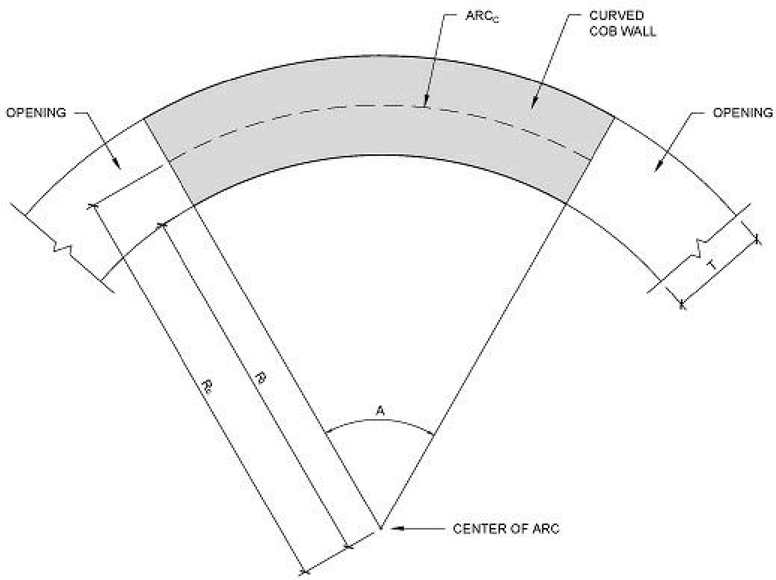


TABLE AU106.11(1) COB BRACED WALL PANEL TYPES

WALL TYPE[a] DESIGNATION	ANCHORS TO FOUNDATION[b]	ANCHORS TO BOND BEAM[c]	VERTICAL STEEL REINFORCING[b, c]	HORIZONTAL STEEL REINFORCING	MAXIMUM HEIGHT H[d] (in feet)	MAXIMUM ASPECT RATIO (H:L)
A	none	5/8” threaded rod @12” 4” from wall ends 12” embedment in cob	none	none	7[e]	1:1
B	#5 bar @ 12” 16” embedment in cob	5/8” threaded rod @12” 4” from wall ends 16” embedment in cob 2”x2”x1/4” washer and nut at cob end	none	2”x2”x14 gage welded wire mesh[f] @ 18”, 6” from foundation and bond beam	7[e]	1:1
C	#5 bar @ 12” 16” embedment in cob	5/8” threaded rod @12” 16” embedment in cob	5/8” threaded rod 4” from each end of braced wall panel continuous from foundation to bond beam	2”x2”x14 gage welded wire mesh[f] @ 18”, 6” from foundation and bond beam	7[e]	2:1
D	(see vertical steel reinforcing)	(see vertical steel reinforcing)	5/8” threaded rod 4” from each end of braced wall panel and @12”, continuous from foundation to bond beam	2”x2”x14 gage welded wire mesh[f] @ 18”, 6” from foundation and bond beam	7[e]	2:1

E	6”x6”x6 gage welded wire mesh 12”embedment in foundation	5/8” threaded rod @12” 4” from wall ends 12” embedment in cob	6”x6”x6 gage welded wire mesh 2” from each wall face	none	7.5	1:1

SI: 1 inch = 25.4 mm.

a. *Braced wall panel* types A, B, C, and D shall be not less than 16 inches thick. *Brace wall panel* type E shall be not less than 12 inches thick. All *braced wall panels* shall be not greater than 24 inches thick.

b. Not less than 8” embedment into foundation, unless otherwise stated.

c. Not less than 4” embedment into concrete bond beams. Full penetration through wood bond beam, secured with nut and washer.

d. *H* = height of the cob portion of the wall only. See Figure AU101.4.

e. Maximum height shall be 8 feet when wall thickness is increased to 18”.

f. Galvanized mesh.

TABLE AU106.11(2) BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED

• EXPOSURE CATEGORY B[d] **• 25-FOOT MEAN ROOF HEIGHT** **• 10-FOOT EAVE-TO-RIDGE HEIGHT[d]** **• 10-FOOT WALL HEIGHT[d]** **• 2 BRACED WALL LINES[d]**			**MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]**			
Ultimate Design Wind Speed **(mph)**	**Story Location**	**Braced Wall Line Spacing (feet)**	**Cob braced wall panel[e] A** **(aspect ratio** **H:L ≤ 1:1)**	**Cob braced wall panel[e] B** **(aspect ratio** **H:L ≤ 1:1)**	**Cob braced wall panel[e] C, D** **(aspect ratio** **H:L ≤ 2:1)**	**Cob braced wall panel[e] E** **(aspect ratio** **H:L ≤ 1:1)**
10	6.0	6.0	3.7	NP	_	_
≤ 110	One-story building	20	7.9	7.4	7.4	NP
30	11.8	11.0	11.0	NP	_	_
10	6.0	6.0	4.1	NP	_	_
≤ 115	One-story building	20	8.7	8.1	8.1	NP
30	13.0	12.1	12.1	NP	_	_
10	6.0	6.0	4.4	NP	_	_
≤ 120	One-story building	20	9.4	8.8	8.8	NP
30	14.1	13.1	13.1	_	_	_
10	6.0	6.0	5.1	NP	_	_
≤ 130	One-story building	20	11.0	10.3	10.3	NP

30	16.5	15.4	15.4	NP	-	-
10	6.0	6.0	5.9	NP	-	-
≤ 140	One-story building	20	12.7	11.9	11.9	NP
30	19.1	17.8	17.8	NP	-	-

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

a. Linear interpolation shall be permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2)

e. *Cob* braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

TABLE AU106.11(3A) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A

• SOIL CLASS D[e] **• TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM)** **• COB WALL HEIGHT PER TABLE AS106.11(1)** **• 15 PSF ROOF-CEILING DEAD LOAD[d]** **• STORY LOCATION: ONE-STORY BUILDING** **• SEISMIC DESIGN CATEGORY A** **• 1.5" PLASTER THICKNESS EACH SIDE[h]**				**MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]**		
Braced wall line spacing (feet)	**Braced wall line length (feet)**	**Braced wall line % openings**	**Perpendicular braced wall line % openings**	**Cob-braced wall panel[e] A, B**	**Cob-braced wall panel[e] C, D**	**Cob-braced wall panel[e] E**
10	30	Any %[g]	Any %[g]	Wind[i]	Wind[i]	NP
20	20	Any %[g]	Any %[g]	Wind[i]	Wind[i]	NP
20	30	Any %[g]	Any %[g]	Wind[i]	4.5	NP
30	30	Any %[g]	Any %[g]	Wind[i]	Wind[i]	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Sections AU106.11.1 and AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code.*

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thickness between 3-inches and 6-inches, the minimum total length of braced wall panels shall be mulitplied by 1.2.

i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).

AU106.11(3B) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B

• SOIL CLASS D[e] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY B • 1.5" PLASTER THICKNESS EACH SIDE[h]				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]		
Braced wall line spacing (feet)	**Braced wall line length (feet)**	**Braced wall line % openings**	**Perpendicular braced wall lines % openings**	**Cob-braced wall panel[e] A, B**	**Cob-braced wall panel[e] C, D**	**Cob-braced wall panel[e] E**
10	10	Any %[g]	Any %[g]	Wind[i]	Wind[i]	NP
10	20	0	Any %[g]	6.0	4.9	NP
10	20	50	Any %[g]	6.0	Wind[i]	NP
10	30	0	Any %[g]	7.1	6.6	NP
10	30	50	Any %[g]	6.0	4.5	NP
20	10	0	0	6.0[i]	4.9[i]	NP
20	10	0	50	6.0	Wind[i]	NP
20	10	50	Any %[g]	6.0	4.2	NP
20	10	50	50	6.0	4.2	NP
20	20	0	0	7.4	6.9	NP
20	20	0	50	6.0	5.5	NP
20	20	50	0	6.0	5.5	NP
20	20	50	50	6.0	4.1	NP
20	30	0	0	9.4	8.8	NP
20	30	0	50	7.9	7.4	NP
20	30	50	0	7.2	6.7	NP
20	30	50	50	6.0	5.3	NP
30	10	Any %[g]	Any %[g]	Wind[i]	Wind[i]	NP
30	20	0	0	9.4	8.8	NP
30	20	0	50	Wind[i]	Wind[i]	NP
30	20	50	Any %[g]	7.9	Wind	NP
30	30	0	0	11.8	11.0	NP
30	30	0	50	9.5	8.9	NP
30	30	50	0	9.5	8.9	NP
30	30	50	50	Wind[i]	Wind[i]	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4)

e. Cob braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *Sds* values associated with the seismic design categories is allowable where a site-specific *Sds* value is determined in accordance with Section 1613.3 of the *International Building Code.*

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thicknesses 3-inches to 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).

j. Total plaster thicknesses shall be not greater than 3-inches. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.11(3C) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C

• SOIL CLASS D[e] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY C • 1.5" PLASTER THICKNESS EACH SIDE[h]				**MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]**		
Braced wall line spacing (feet)	**Braced wall line length (feet)**	**Braced wall line % openings**	**Perpendicular braced wall lines % openings**	**Cob-braced wall panel[e] A, B**	**Cob-braced wall panel[e] C, D**	**Cob-braced wall panel[e] E**
10	10	0	0	8.3[i]	7.8[i]	NP
10	10	0	50	6.5	6.1	NP
10	10	25	0	7.4[i]	6.9[i]	NP
10	10	50	50	4.7	4.4	NP
10	15	0	0	10.6	9.9	NP
10	15	0	50	8.7	8.2	NP
10	15	50	0	7.8	7.3	NP
10	15	50	50	6.0	5.6	NP
10	20	0	0	12.8	11.9	NP
10	20	0	50	11.0	10.2	NP
10	20	50	0	9.1	8.5	NP
10	20	50	50	7.3	6.8	NP
15	10	25	0	9.6	9.0	NP
15	10	0	50	7.8	7.3	NP
15	10	50	0	8.7	8.2	NP
15	10	50	50	6.0	5.6	NP
15	15	0	0	12.9	12.1	NP

15	15	0	50	10.2	9.5	NP
15	15	50	0	10.2	9.5	NP
15	15	50	50	7.5	7.0	NP
15	20	0	0	15.3	14.3	NP
15	20	0	50	12.6	11.7	NP
15	20	50	0	11.7	10.9	NP
15	20	50	50	8.9	8.3	NP
20	10	25	0	NP	NP	NP
20	10	0	50	9.1	8.5	NP
20	10	50	Any %[g]	NP	NP	NP
20	10	50	50	7.3	6.8	NP
20	15	0	0	NP	NP	NP
20	15	0	50	11.7[i]	10.9[i]	NP
20	15	50	0	NP	NP	NP
20	15	50	50	8.9[i]	8.3[i]	NP
20	20	0	0	NP	NP	NP
20	20	0	50	14.2	13.3	NP
20	20	50	0	NP	NP	NP
20	20	50	50	NP	9.9	NP

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *Sds* values associated with the seismic design categories is allowable where a site-specific *Sds* value is determined in accordance with Section 1613.3 of the *International Building Code*.

g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).

h. For total plaster thicknesses 3" to 6", multiply the minimum total length of braced wall panels by 1.2.

i. Total plaster thickness > 3" is not permitted. Substitute 15/32" roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.12 Resistance to wind uplift forces. *Cob* walls that resist uplift forces from the roof assembly, as determined in accordance with Section R802.11, shall be in accordance with Table AU106.12.

TABLE AU106.12 ANCHORAGE OF BOND BEAMS FOR WIND UPLIFT

· ANCHORS: 5/8" ALL THREAD AT 12" O.C. [a, b] **· 2"x2"x1/4" WASHERS AND NUT AT END IN COB** **· 4" EMBEDMENT IN CONCRETE BOND BEAMS** **· FULL PENETRATION THROUGH WOOD BOND BEAMS WITH 2"X2"X1/4" WASHER AND NUT**
ANCHORAGE DEPTH IN INCHES, PER WALL WIDTH AND WIND UPLIFT FORCE

WIND UPLIFT FORCE FROM TABLE R802.11 (PLF)	≤ 12” wall width[c]	≤ 16” wall width[c]	≤ 24” wall width[c]
< 75	16	12	12
< 100	24	16	12
< 150	4’ o.c. continuous from foundation to bond beam[d]	24	16
< 200	4’ o.c. continuous from foundation to bond beam[d]	4’ o.c. continuous from foundation to bond beam[d]	24

a. For wood bond beams a maximum of 6” from bond beam ends.

b. For min. 6”x8” concrete bond beams, at 18” o.c. for wind uplift forces < 75 plf., and at 16” o..c for wind uplift forces < 100 plf.

c. Excluding finishes.

d. With 7-inch embedment in foundation, 4-inch embedment in concrete bond beam or full penetration through wood bond beam with 2”x2”x1/4” washer and nut.

AU106.13 Post-and-beam with cob infill. Post-and-beam with *cob* infill wall systems shall be in accordance with an *approved* engineered design.

AU106.14 Buttresses. *Cob* buttresses that are intended to provide out-of-plane wall bracing, or additional capacity for *braced wall panels* shall be in accordance with an *approved* engineered design.

SECTION AU107
COB FLOORS

AU107.1 Cob floors. *Cob* floors supported by grade shall be in accordance with an *approved* specification. Straw shall not be required in the material mix.

SECTION AU108
FIRE RESISTANCE

AU108.1 Fire-resistance rating. *Cob* walls shall be considered to exhibit a 1-hour fire-resistance rating in accordance with the following:

1. Wall thickness shall be 10 inches (254 mm) or greater.
2. Density shall be 70 pcf (1121 kg/m^3) or greater.
3. When used as a *load-bearing wall*, the maximum design load shall be 1000 pounds per lineal foot (14,590 N/m) in accordance with Section AS106.8.
4. When used as a *braced wall panel*, the wall shall be in accordance with Section AS106.11.

AU108.2 Clearance to fireplaces and chimneys. *Cob* walls or other *cob* surfaces shall not require clearance to fireplaces and chimneys, except where clearance to non-combustibles is required by the manufacturer’s instructions.

SECTION AU109
THERMAL PERFORMANCE

AU109.1 Thermal characteristics. *Cob walls* shall be classified as mass walls in accordance with Section N1102.2.5 (R402.2.5) and shall meet the R-value requirements for mass walls in Table N1102.1.2 (R402.1.2).

AU109.2 Thermal resistance. The unit R-value for *cob* walls with a density of 110 pcf (1762 kg/m^3) shall be R-0.22 per inch of *cob* thickness. Walls that vary in thickness along their height or length shall use the average thickness of the wall to determine its R-value. The thermal resistance values of air films and finish materials or additional insulation shall be added to the cob wall's thermal resistance value to determine the R-value of the wall assembly.

AU109.3 Additional insulation. When insulating materials are added to the face of a *cob* wall, the combination of additional insulation and any associated connecting, weather-resisting, or protective materials shall comply with Section AU104.1, Items 1-4.

SECTION AU110 REFERENCED STANDARDS ASTM C5—10 Standard Specification for Quicklime for Structural Purposes - AU104.4.6.1

ASTM C141/C141M—14 Standard Specification for Hydrated Hydraulic Lime for Structural Purposes - AU104.4.6.1

ASTM C206—14 Standard Specification for Finishing Hydrated Lime - AU104.4.6.1

ASTM C1707—11 Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes - AU104.4.6.1

ASTM E2392/ E2392M—10 Standard Guide for Design of Earthen Wall Building Systems - AU104.4.3.2

ASTM BS1, ASTM BS EN 459—2015 Part 1: Building Lime. Definitions, Specifications and Conformity Criteria; Part 2: Test Methods - AU104.4.6.1

Reason: Cob is an earthen material mix of clay-soil, sand, straw, and water, placed onto a wall in layers to create a monolithic wall. Because the material mix and density of cob are very similar to those of adobe bricks, cob is sometimes known as “monolithic adobe.”
Cob has been used for thousands of years around the world, notably in England and Northern Europe, the Middle East, West Africa, China, and the Southwestern United States. An estimated 20,000 cob homes are still inhabited in the English county of Devon alone, some dating from the 15th century. The term “cob” derives from an Old English word for “lump,” since historical structures were often constructed one handful at a time.

Today, cob is often mixed mechanically using a tractor or mortar mixer, but the wall construction is still generally manual. Cob buildings typically feature raised impermeable foundations and extended roof eaves to protect the walls from moisture and weather. Walls are often plastered with clay, lime or gypsum plasters which protect and beautify the cob without leading to the moisture problems associated with less vapor-permeable finishes such as cement stucco on historic adobe structures.

Since the 1990’s, there has been increasing interest in cob construction in the United States and much of the world. Like other earthen construction methods, cob can greatly reduce embodied energy and life-cycle CO_2 emissions of buildings. Cob is highly recyclable, and with good design, construction and maintenance, can withstand centuries of use. The constituent materials are inexpensive compared with lumber, steel, concrete and other commonly used building materials. Cob is non-combustible and non-toxic in all stages of construction and use. Cob’s thermal mass and moisture management properties modulate interior temperature and humidity, creating healthful building.

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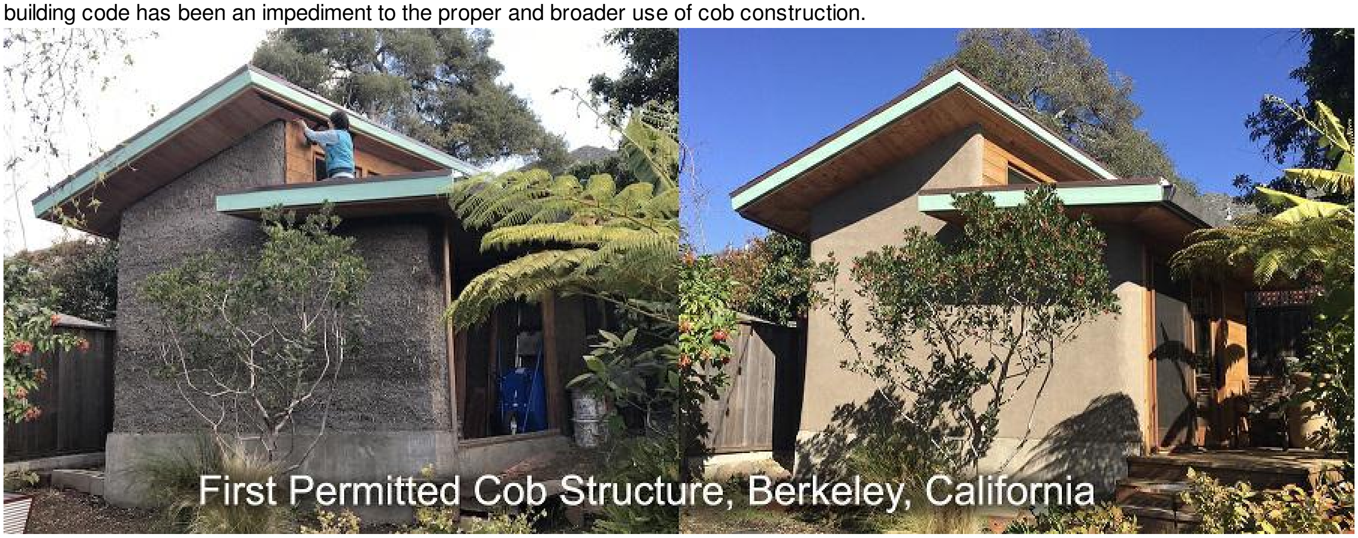
While adobe is included in the masonry chapter of the IBC, and cob building codes or guidelines exist in England and New Zealand, there is currently no cob building code in the United States. As a result, permitting of cob buildings has been left to individual building officials on a case-by-case basis. Designers, builders and officials may be unaware of proper practices to make cob buildings safe and durable. Nevertheless, the desire to utilize cob construction continues, and promises to accelerate in response to economic and environmental pressures. These include the need for non-combustible construction systems that can withstand the increased frequency and intensity of wildfires in the western U.S. The lack of a cob building code has been an impediment to the proper and broader use of cob construction.



The proposed Cob Construction appendix for the IRC was created in response to this need. It is based on New Zealand's earthen building standards, on US codes for the closely-related earthen building systems of adobe and straw-clay, and on the experience and the testing of cob buildings over the past 25 years by architects, engineers, builders, and academics throughout the U.S. and the world. It has received review and input from over 25 experts including 4 architects and 6 civil engineers, including the architect and chair of the Committee that developed the New Zealand Standard for Earth Buildings. Much of the recent testing and research has been compiled or performed by the California-based Cob Research Institute, a non-profit organization founded in 2008 to remove legal barriers to cob construction and promote its safe use. If adopted, the proposed appendix will serve designers, builders, owners, inhabitants, and building officials alike in the design and construction of safe and durable cob buildings.

Supporting documents for the proposed Cob Construction appendix is available at: https://www.cobcode.org/cobcode-documents

Rationale for Specific Sections of Proposed Appendix U – Cob Construction

GENERAL:

Cob construction can help address the increasing need to reduce our buildings' negative impacts on the environment, including the global climate, and address the impacts of a changing climate on buildings, including increased firestorms. Like other earthen wall systems, cob is among the most fire-resistant building materials available, while also having a low environmental impact. The ability to build with site- or locally-sourced materials further reduces processing and transportation impacts as well as costs.

Though cob construction is not an industrialized building system, its centuries of continuous use in many parts of the world provide empirical evidence and guidance for good practice. This appendix gives the building official greater flexibility to consider empirical evidence and lifecycle impacts in meeting the intent of the code while not abridging health and life-safety requirements.

DEFINITIONS:

Cob-specific terms not found in the IRC are defined. Some terms already defined in the IRC are adjusted to give specific meaning for cob construction. Some definitions are consistent with identical terms defined in IRC Appendix R – Light Straw Clay Construction, and Appendix S – Strawbale Construction.

MATERIALS, MIXING AND INSTALLATION:

The provisions for materials, mixing, and installation are based on existing codes, standards, and guidelines from the UK, New Zealand and the U.S., including ASTM E2392-10 Standard Guide for the Design of Earthen Wall Systems, as well as the experience of designers and builders of cob and earthen buildings in the U.S. and other countries.

Though the materials for cob can vary considerably, the material specifications coupled with the mix design tests for shrinkage, compressive strength and modulus of rupture ensure adequate strength and stability of the wall materials.

FINISHES:

Where cob walls are not substantially rain-exposed they are allowed to remain without finish. Minor erosion has proven to be acceptable on cob walls, and is a matter of maintenance, not unlike the need to periodically repaint the exterior of buildings of conventional construction. However, where cob walls are susceptible to excessive erosion or water intrusion from weather, finishes are necessary to protect the wall while ensuring that any moisture that might enter the wall is able to escape without causing harm. Thus, finishes and finish assemblies must be a minimum of 5 perms, the IRC defined threshold of vapor permeable. Class I and II vapor retarders are prohibited on cob walls except where specifically permitted or required, for example at showers.

A range of plaster types are allowed and described, specifying critical components and characteristics of the plasters, the recognized standards with which they must comply, and other necessary details for their installation. The plasters allowed in the appendix have a history of successful use on cob and other earthen wall systems.

Non-plaster finishes systems are allowed with approved specifications that ensure: adequate attachment or support, the ability to safely discharge moisture, a minimum vapor permeance rating, and compliance with stated weight limits.

COB WALLS - GENERAL:

General limits are given for all cob buildings, including: one story; maximum building height of 25 feet; Seismic Design Categories A, B, and C (except with an approved engineered design); wall height and wall thickness limitations; and an approved engineered design for interior cob walls that addresses their seismic lateral loads (except in Seismic Design Category A).

A method of out-of-plane resistance is required for all walls, and wall height limits are given. Bond beams are required and described for all cob walls, as are lintels over door and window openings. Reinforcing at window and door openings is required for openings wider than 2 feet. Window openings are limited to 6 feet in width and horizontal and vertical reinforcing at window and door openings is required and described. A minimum cob wall length between openings is given and reinforcing required to ensure the wall's stability.

Moisture control requirements address potential moisture intrusion from rain or snow, or through capillary action from the ground and help ensure that moisture that might enter is not trapped. That protection includes limiting the use of membranes and barriers between the cob and plaster finishes. Limiting the use of membranes also enables a mechanical bond between the plaster and the cob.

A Class I or II vapor retarder is required between the bottom of the cob wall and the foundation to prevent ground moisture from rising into the wall, unless the particular project conditions and design eliminate this need. A minimum separation of the cob wall above finished grade is required. Protection of horizontal surfaces is required to prevent erosion and water intrusion.

Requirements for installing windows and doors are given so they are secure and prevent the passage of air or moisture through or into the wall.

In addition to inspections normally required, inspections specific to cob construction are required for the anchors connecting cob walls to the foundation and the bond beam, for required vertical or horizontal reinforcing in the walls, and for reinforcing in any concrete bond beams or lintels.

COB WALLS - STRUCTURAL:

Cob walls are a compression dominant wall system containing a micro-reinforcing system of straw throughout. Testing has shown this increases ductility compared to earthen materials with no straw. Cob can be reinforced with other standard reinforcing materials such as steel bar and welded wire mesh, making it akin to concrete construction in this respect. Cob wall systems using these reinforcing materials are included in the proposed appendix.

University and independent lab structural tests on cob have been conducted and documented since the 1990s. Testing this proposed code has used as the bases of its analysis include: In-Plane Reverse Cyclic Tests as well as small scale batch testing at Santa Clara University; Small Scale batch testing at the University of Plymouth (England); Federal Institute for Materials Research and Testing, Berlin, Germany; The University of Oregon; Wuhan University of Technology, China; the University of San Francisco; and the Washington State University. Shake table test results were also used from the University of Sydney (Australia), and the University of British Columbia (Canada).

This proposed code also drew on the following codes, standards and earthen engineering texts: ASTM E2392 Standard Guide for Design of Earthen Wall Building Systems; the engineered and prescriptive New Zealand Standard for Earth Buildings NZS4297-99; The New Mexico Earthen Building Materials Code; the prescriptive German Earthen Building Standard, DIN 4102; and earthen engineering texts such as Building with Earth: Design and Technology of a Sustainable Architecture, by Gernot Minke.

Gravity load-bearing values are based on project specific, required material tests. Lateral loads are limited to Seismic Design Categories (SDC) A, B, and C, with increased safety factors and decreased Response Modification Factors for SDC C. Gravity and earthquake effects of the cob weight itself have been generated assuming a material density of 110 pcf which is the upper limit of density for all tests assessed. A common density range of 80-105 pcf is expected in the field. Appropriate adjustment factors have been applied for other structural elements and connections contained in other parts of the IRC that may be uniquely affected by the increased dead load of cob walls, such as the roof diaphragm. A full report of the structural analysis that generated this proposed appendix is available at: https://www.cobcode.org/cobcode-documents

COB FLOORS:

Cob floors on grade, with or without straw, are permitted in cob buildings, but the specifications must be approved by the building official. There are numerous viable cob floor systems. The modern evolution and growing use of cob and other earthen floors in high-end custom homes is testament to their serviceability, aesthetic appeal, and low environmental impact.

FIRE RESISTANCE:

ASTM E119 Fire-Resistance Rating Equivalency for Monolithic Adobe (Cob) walls.

To establish the minimum 1-hour fire resistance rating for a 10" thick cob wall included in this appendix, extensive research was done into existing ratings in codes and standards, testing, and fire experience in earthen wall buildings. A technical equivalency evaluation was conducted by Reax Engineering, Inc., which is summarized below. In addition, it is worth noting that in Australia as in the western U.S., devastating wildfires, or bushfires as they are called in Australia, have been increasing in frequency and intensity. Because of a tradition of buildings with earthen walls in areas that have experienced the most intense bushfires, they have had the opportunity to observe how earthen walls perform in firestorms.

The Australian Standard AS 3959-2009, "Construction of buildings in bushfire-prone areas," was developed as a result. This standard lists "earth wall including mud brick" as one of only three external wall materials not needing additional testing even in the most extreme and vulnerable bushfire zones, BAL FZ (Bushfire Attack Level- Flame Zone). The standard stipulates that the exposed components of external walls shall be of non-combustible material at least 90mm (3.54 inches) thick. Along with earth walls, the other materials listed as acceptable without additional testing for external walls are full masonry and precast or in situ concrete. The minimum 10-inch thick 1-hour cob wall in this proposed appendix is almost three times as thick as the minimum thickness of the earth wall accepted by that standard for the highest fire risk zones in Australia.

Additionally, the Australian Earth Building Handbook, HB195-2002, in Section 4.6 Fire Resistance Level, states, "In the absence of specific test data, the general fire resistance level (FRL) of earth walls satisfying the minimum thickness requirements outlined in Clause 4.3.4 may be taken as not greater than 120/120/120, or 90/90/90 where wall thickness is less than 200 mm." Clause 4.3.4 Structural Adequacy states: "Minimum recommended thicknesses for mud brick, stabilized pressed block and rammed earth are as follows: External walling - 200 mm, Internal walling - 125 mm. The minimum wall thickness for poured earth and cob wall construction is also recommended to be 200 mm, though in practice wall thickness will often exceed this value."

The three numbers in the FRL represent minutes before failure for structural adequacy/integrity/insulation. In other words the time for the wall to be able to maintain a load, maintain its integrity, and before heat increase on the unheated side of the wall exceeds accepted limits. Thus Australia gives a 2-hour fire resistance rating for a 200 mm (7.87") earth wall. This Standards Australia handbook is available via the supporting documents link above.

Summary of the Reax Engineering Inc. evaluation and analysis of historical tests and other relevant evidence to determine a fire-resistance rating equivalency for cob walls.

Code Requirement

IRC Section R302.1 Exterior Walls and Table R302.1(1) requires 1-hour fire-resistance rated walls to be tested in accordance with ASTM E119 or UL 263 with exposure from both sides. E119 fire-resistance ratings ≥ 1 hour must include a one-minute hose stream test following the fire-resistance test.

Proposed Equivalency

ASTM E119 and equivalent international tests AS 1530 and EN 1363 on closely-related compressed earth block and adobe block walls, were used to demonstrate a minimum of 1-hour fire resistance of Monolithic Adobe (Cob) walls greater than or equal to 10 inches thick, including a significant factor of safety.

Rational Engineering Analysis of Proposed Equivalency

Reax Engineering Inc. evaluated results from standardized testing, published standards, and empirical evidence, to establish a conservative minimum value for the fire resistance of monolithic adobe (sand, straw and unfired clay in monolithic form). Data was from allied construction systems using the same sand, clay, straw materials in brick form (brick and monolithic walls of these materials are referred to collectively as "earthen walls").

The tests are described below and summarized in Table 1. All tests except test (c) (run to insulation failure) passed all parameters tested: loadbearing, integrity, insulation. Test (a) also included and passed a hose stream test. All wall specimen sizes were 10' x 10' or the close metric equivalent of 3.1 x 3.1 meters.

Test Descriptions

a. A test of a 10" thick, compressed earth block wall was conducted in 2013 in Texas to the ASTM E119 2-hour load-bearing standard. Results for the test including the hose stream component are proprietary but a video is available at the following link: Urban Earth Fire Resistance Test (video)

b. A test of a 9.84" thick compressed earth block wall was conducted in 2011 in South Africa to a 1-hour standard using an ISO 834 time/temperature curve identical to the ASTM E119 temperature curve. This test provided the basis for a 2-hour loadbearing fire-resistance rating for 9.84" thick compressed earth block wall.

c. A test of a 5.9" thick Cinva-ram earth block wall was conducted in Australia to insulation failure at 3 hrs 41 minutes, to the AS1530.4 standard. It was reported in the Commonwealth Scientific and Industrial Research Organization's (CSIRO) Bulletin 5: Earth Wall Construction, 1976. CISRO is an independent Australian federal government agency responsible for scientific research.

d. A test was conducted in Australia in 1982 to the AS1530.4-1975 4-hour standard, which is nearly identical to the ASTM E119 4-hour standard. The test provided a 4-hour loadbearing fire-resistance rating for a 9.8" thick adobe block wall. The test was stopped after 4 hours. Researchers extrapolated a 6 to 7-hour rating had the test continued, with heat rise on the unexposed face the predicted limiting factor.

e. A test of a 5.9" thick walls was conducted at the Laboratory for Structures and Fire Resistance at the University of Aveiro, Portugal, using ISO 834 time-temp curve and the European Standards for testing fire resistance (EN1363-1 and EN 1364-1). One wall tested soil stabilized with cement, and one tested soil stabilized with Kraft fibers.

Table 1. Summary of Testing

Test	Material	Rating (hours) / Test duration (hours)	Load Bearing	Hose Stream	Thickness (in.)	Standard / Variation from E119
a	Compressed Earth Block	2.0 / 2.4	Y	Pass	10	ASTM E119 / no variation
b	Compressed Earth Block	2.0 / 2.4	Y	Not done	9.84	ISO 834 / Nearly identical to ASTM E119
c	Ram Earth Block	3.6 / 7.3	Y	Not done	5.9	AS 1530-1975 / Based on ISO 834
d	Adobe Block	4.0 / 4.9	Y	Not done	9.8	AS 1530-1975 / Based on ISO 834

e	Compressed Earth Block	2.0 / 4.1	N	Not done	5.9	EN 1363-1 w ISO 834 time temp curve to 120 minutes

Several of these tests are on compressed earth block systems which lack the straw component of cob wall construction. Straw adds resistance to heat transfer thus decreasing the rate of surface temperature rise on the unexposed side. Straw in the wall will not combust due to lack of oxygen, and it will continue to offer its primary role in adobe of limiting crack propagation, a property expected to enhance a cob wall's resistance to thermally induced structural failure.

As a massive system, a monolithic adobe wall can absorb a significantly greater amount of heat when compared to a standard stuccoed wood-framed wall. For slow growing fires, this translates to less heat on the interior, and prolonged time to flashover with increased protection and time for escape.

Photos were reviewed of surviving earthen walls with completely incinerated wooden floor and roof structures in California and Australian firestorms. These show further evidence of the resistance of earthen wall systems to intense fire conditions.

Monolithic adobe is used to construct fireplaces, ovens, kilns, and forges, a testament to its ability to contain fire. It is favored for these applications over concrete, rock, and red brick, for its lesser tendency to crack or spall.

Comparison to Tests and Adopted Standards

The engineering judgment was checked against standards from two jurisdictions with prescribed fire-resistance ratings for earthen walls. The Pima County Approved Standard for Earthen IBC Structures, provides a 2-hour rating for a 10" thick wall. New Zealand's NZS 4297 Engineering Design of Earth Buildings provides a 2-hour rating for a 5.9" thick wall. Thus an engineering judgment of a 1-hour fire-resistance rating for a 10" thick monolithic adobe wall provides a 100% safety margin compared to these standards and as compared to four of the five described tests. A 1-hour rating provides a 300% safety margin compared with the Australian adobe block test that yielded a 4-hour rating.

Conclusion

All relevant evidence strongly supports the judgment that monolithic adobe (cob) walls constructed to a minimum thickness of 10 inches provide a conservative minimum fire-resistance rating of 1-hour.

Fire testing reports, related documents and the equivalency report are available at https://www.cobcode.org/cobcode-documents

THERMAL PERFORMANCE:

Cob walls are classified as mass walls in accordance with Section N1102.2.5 because the heat capacity of cob walls is greater than the 6 $Btu/ft^2 \times {}^oF$ threshold defined in that section. The lowest heat capacity of a cob wall is 16 $Btu/ft^2 \times {}^oF$, for the required minimum wall thickness of 10" and at the lowest practical density of 70 pcf.

Cob's assigned unit R-value of 0.22 per inch with a density of 110 pcf was determined with an ASTM C1363 thermal resistance test at Intertek Laboratory in Fresno, CA in December 2018. The R-value of the wall assembly is determined by adding the thermal resistance of the air films and any finish or additional insulation.

Adding insulation to the face of cob walls can allow them to be used more readily in cold climates. This is_allowed, providing the insulation assembly complies with the requirement in Section AU104.1 for attachment or support, vapor permeance, and weight limits.

Bibliography: *The following documents relate to one or more categories in the code proposal as indicated: General (G), Structural (S), Fire (F).*
Australian Earth Building Handbook, HB195-2002, Peter Walker, Standards Australia. *G, S, F*

CSIRO-Australia, Bulletin 5 Earth-Wall Construction 4^{th} Edition, 1992 Division of Building Construction and Engineering. *G, S, F*

AS 3959-2009, Australian Standard Construction of Buildings in Bushfire Prone Areas, (incorporating Amendments 1, 2 and 3), Standards Australia, 2009-2011. *S, F*

NZS 4297.1998 Engineering Design of Earth Buildings, Standards New Zealand, 1998. *S, F*

NZS 4298.1998, Materials and Workmanship for Earth Buildings, Standards New Zealand, 2000 (incorporates June 2000 Amendment). *G, S*

NZS 4299.1998, Earth Buildings Not Requiring Specific Design, Standards New Zealand, 1999 (incorporates December 1999 amendment). *G, S*

"NZS 4297-99, The New Zealand Earth Building Standards: Their History and Current Status," Graeme North and Min Hall, 2018. *G, S*

"Moisture Properties of Plaster and Stucco for Strawbale Buildings," John Straube, PE, 2003 *G*

CSIRO EBS Technical Record 490, "Fire-Resistance Test on a Loadbearing Masonry Wall of 250mm-Thick Adobe Blockwork," Experimental Building Station, Australia, 1982. *F*

AS 1530 Part 4-1975 Fire Tests on Building Materials and Structures: Part 4-Fire-Resistance Tests of Structures, Standards Association of Australia, 1975. *F*

"Review of Rammed Earth Construction: Developing Rammed Earth for UK Housing," Vasilios Maniatidis, Peter Walker, Natural Building Technology Group, University of Bath, 2003 *G, S, F*

Keynote Address, "Rammed Earth Building in (western) Australia and Earthbuilding worldwide," Earth Building Association of Australia, Stephen Dobson, 2009. *F*

Cob Dwellings: Compliance with The Building Regulations 2000 (as amended), The 2008 Devon Model, Devon Earth Building Association, 2008. *G, S, F*

"Fire resistance of walls made of soil-cement and Kraftterra compressed earth blocks," M. Buson, N. Lopes, H. Varum, R. M. Sposto, P. Vila Real, 2012. *G, S, F*

Tucson-Pima County Arizona Earthen Building Code. 1997. *G, S, F*

New Mexico Earthen Building Code, 2009. *G, S, F*

"Evaluation of ASTM E119 Fire Rating Equivalency for Monolithic Adobe (Cob) Walls," David Rich, Reax Engineering, 2019. *F*"ASTM 1-Hour E-119 Non-Bearing Straw Bale Clay Plastered Wall," Intertek Test Report, 2007. *F*

ASTM E2392-10 Standard Guide for the Design of Earthen Wall Systems. *G, S*

"Cob: A Sustainable Building Material," D. Eberhard, J. Novara, B. Popovec, Santa Clara University Department of Civil Engineering, 2018. *S*

"Cob Property Analysis," G. Brunello, J. Espinoza, A. Golitz, Santa Clara University Department of Civil Engineering, 2018. *S*

Building With Earth: Design and Technology of Sustainable Architecture, Gernot Minke, 2006. *G, S*

"Transforming building regulatory systems to address climate change," David Eisenberg, Building Research and Information, 2016. *G*

Cost Impact: The code change proposal will not increase or decrease the cost of construction
As a wall system cob can be more costly or less costly than conventional wall systems found in the IRC, depending on many variables. The materials for cob walls or clay soil (often from the site), sand, and straw are relatively inexpensive whereas the cob walls can be more labor intensive. Other elements or systems in the building such as the foundation, roof, electrical, plumbing and mechanical can be very similar to those used in conventional construction and therefore the same cost. As an overview this proposal will not affect the cost of construction.

RB299-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is a lot of information to take in here. There are still questions regarding the fire rated assemblies, the efficiency....etc. It says to comply with this code. There is not a good pathway that allows some of the items in this type of construction to comply with that. This has to be addressed. This is a style of construction that goes back hundreds or years and a lot of effort went into this proposal, but it still needs to get better. The assumed 1 hour fire-resistance rating is not supported by tests. We cannot extrapolate from small scale testing. The committee encourages the proponents to continue the development of the proposal. The coordination effort is impressive. We need construction that will meet the challenges of wildfires. Australian experts contacted indicate that houses constructed in accordance with AS 3959 may burn down during a brush fire, but if the residents survive the initial fire front, it is seen as success for the standard. Houses constructed to AS 3959 have a much better chance of surviving a brush fire than others. This type of construction has been successful. But we need to see full scale test results. The committee looks forward to further development in the public comment period. (Vote: 10-1)

Assembly Action: **None**

RB299-19

Individual Consideration Agenda

Public Comment 1:

IRC®: APPENDIX U (New), AU104.1 (New), AU104.1.1 (New), AU104.1.2 (New), AU105.2 (New), TABLE AU105.3 (New), AU105.5 (New), AU106.2 (New), AU106.9.1.3 (New), AU106.9.5 (New), Figure AU106.9.5 (New), AU106.9.6 (New), Figure AU106.9.6 (New), AU106.11.1 (New), AU106.11.2 (New), TABLE AU106.11(2) (New), TABLE AU106.11(3A) (New), AU106.11(3B) (New), AU106.11(3C) (New), AU108.1 (New)

Proponents:
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requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

APPENDIX U
Cob Construction (Monolithic Adobe)

AU104.1 General. *Cob* walls shall not require a *finish*, except as required by Section AU104.2. Finishes applied to *cob* walls shall comply with this section and with Chapters 3 and 7 unless stated otherwise in this section.~~be plasters in accordance with Section AU104.4, non-plaster exterior wall coverings in accordance with Section R703 or other finish systems in accordance with the following:~~

1. ~~Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.~~
2. ~~The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.~~
3. ~~Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m^2) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.~~
4. ~~Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m^2) of wall area shall require an engineered design.~~

AU104.1.1 Interior wall finishes. Where installed,interior wall finishes and interior fire protection shall comply with the applicable provisions of Section R302, and shall be plasters in accordance with Section AU104.4, or non-plaster wall coverings in accordance with Section R702 .

AU104.1.2 Exterior wall finishes. Where installed, exterior wall finishes shall be plasters in accordance with Section AU104.4, or non-plaster exterior wall coverings in accordance with Section R703, or other finish systems in accordance with the following:

1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.
3. Finish systems with weights >10 and ≤ 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m^2) of wall shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.
4. Finish systems with weights > 20 pounds per square foot (> 97.8 kg/m^2) of wall area shall require an engineered design.

AU105.2 Building limitations and requirements for cob wall construction. *Cob* walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one.

2. *Building* height: not more than ~~25~~ 20 feet (~~7620~~ 6096 mm).
3. Seismic design categories: limited to use in Seismic Design Categories A, B and C, except where an *approved* engineered design is provided.
4. Wall height: in accordance with Table ~~AU105.4~~ AU105.3, and with Table AU106.11(1) for *braced wall panels*.
5. Wall thickness, excluding finish, shall be not less than 10 inches, not greater than 24 inches at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2(2). Wall taper is permitted in accordance with Section AU106.5(1).
6. Interior *cob* walls shall require an *approved* engineered design that accounts for the seismic load of the interior *cob* walls, except in Seismic Design Category A for walls with a height to thickness ratio ≤ to 6.

TABLE AU105.3 OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS

WALL TYPE[a, g, h] and METHOD OF OUT-OF-PLANE LOAD RESISTANCE	**FOR ULTIMATE DESIGN WIND SPEEDS (mph)**	**FOR SEISMIC DESIGN CATEGORIES**	**UNRESTRAINED COB WALL HEIGHT H[b, c]**		**TOP ANCHOR[e] SPACING (inches)**	**TENSION TIE[f] SPACING (inches)**
			Absolute limit in feet	**Limit based on wall thickness T[d] in feet**		
Wall 1[i]: no anchors, no steel wall reinforcing	≤ 110	A	*H* ≤ 8	*H* ≤ 6*T*	none	48
Wall 2: top anchors[j], continuous vertical 6”x6”x6 gage steel mesh in center of wall embedded in foundation 12”	≤ 140	A, B, C	*H* ≤ 8	*H* ≤ 8*T*	12	24
Wall A[i]: top anchors, no vertical steel reinforcing	≤ 120	A, B	*H* ≤ 8	*H* ≤ 6*T*	12	48
Wall B[i]: top & bottom anchors, no vertical steel reinforcing	≤ 130	A, B	*H* ≤ 8	*H* ≤ 6*T*	12	48
Wall C: top and bottom anchors, continuous vertical threaded rod at 4’ oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	*H* ≤ 8	*H* ≤ 8*T*	12	24
Wall D: continuous vertical threaded rod at 1’ oc embedded in foundation and connected to bond beam	≤ 140	A, B, C	*H* ≤ 8	*H* ≤ 8*T*	NA	24
Wall E: top anchors, continuous vertical 6”x6”x6 gage steel mesh 2” from each face of wall embedded in foundation	≤ 140	A, B, C	*H* ≤ 8	*H* ≤ 8*T*	12	24

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

N/A = Not Applicable

a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall types A, B, C, D and E.

b. *H* = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.

c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an *approved* engineered design.

d. *T* = Cob wall thickness (in feet) at its minimum, without plaster.

e. 5/8-inch threaded rod anchors at prescribed spacing with 12” embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.

f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure ~~R608.9(9)~~ AU106.9.5. Where rafters are attached to tension ties shall, roof sheathing shall be edge nailed.

g. All walls shall be tested for compressive strength in accordance with Section AU106.6.

h. For curved walls with an arc length:radius ratio of 1.5:1 or greater, the H/T factor shall be increased by 1, and the absolute height limit by 1 foot.

i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.

j. See wall type A in Table AU106.11(1) for top anchor requirements.

AU105.5 Inspections. The *building official* shall inspect the following aspects of *cob construction* in addition to the required tests of, and accordance with Section R109.1:

1. Anchors and vertical and horizontal reinforcing in *cob* walls, where required in accordance with Tables ~~AU105.2~~ AU105.3 and AU106.11(1) and Sections AU105.3.4 and AU105.3.5.
2. Reinforcing in any concrete bond beams or lintels, in accordance with Sections AU106.9.2 and Table AU106.10.

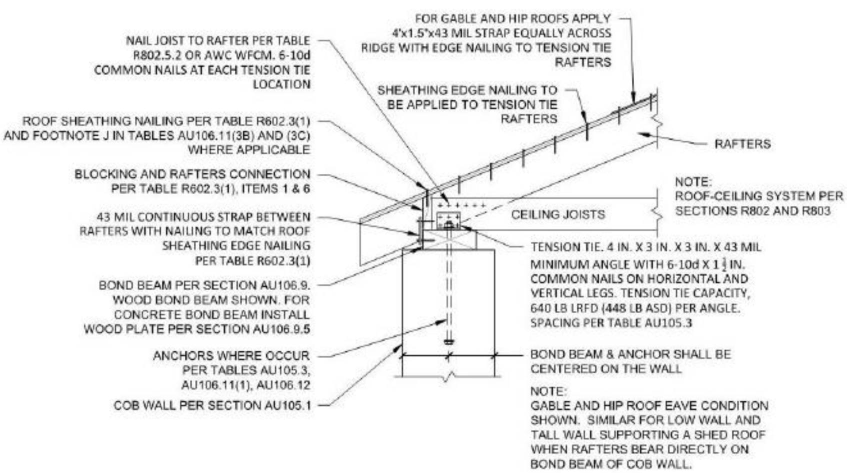
AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, *cob structural walls* shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing cob walls or AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
2. Wall thickness: shall be in accordance with Section AU105.2(5) and Section AU106.8.1 for load-bearing cob walls or Table AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
3. *Braced wall panel* lengths: for *buildings* using *cob braced wall panels*, the greater of the values determined in accordance with Tables AU106.11(2) for wind loads and AU106.11(3 A) , AU106.11(3B), or AU106.11(3C) for seismic loads shall be used.

AU106.9.1.3 Corners and curved walls. Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined ~~in~~ in accordance with Section AU106.9. 1.2.

AU106.9.5 Connection of roof framing to bond beams. Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2~~,~~ and 6~~, 30, 31 and 32~~ and Figure AU106.9.5 . Roof sheathing shall be attached to roof framing in accordance with Figure AU106.9.5. ~~Tension ties shall be provided in accordance with Figure R608.9(9) and Footnote f of Table AU105.3. 10d toe nails at 6 inches (152 mm) on center shall be provided from the rim blocking to top plate for the entirety of braced wall lines, instead of the43 mil strap shown in Figure R608.9(9).~~ A minimum nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with 5/8-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and straps~~toe nailing of rim blocking~~.

Figure AU106.9.5 Connection Of Roof Framing To Bond Beams



AU106.9.6 Bond beams and connections at gable and shed roof end walls. Bond beams and connections at end walls of buildings with gable roofs ~~or~~ and shed roofs shall comply with Figure AU106.9.6 and the following:

1. End walls shall not exceed 20 feet (6096 mm) in length.
2. ~~Shall~~ Bond beams shall be continuous and straight for the entire wall line.
3. Wood bond beams when used shall comply with the following:

   3.1. Not less than nominal 4x8 (102 mm by 203 mm) when wind design governs in accordance with Table~~s~~ AU106.11(2), and when seismic design governs in accordance with Tables AU106.11(3 A) , AU106.11(3B), or AU106.11(3C) , ~~and~~ for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category A, ~~and for~~ or wall lengths ≤ 10 feet (3048 mm) in Seismic Design Categories B and C.

   3.2. Not less than nominal 4x10 (102 mm by 254 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category B.

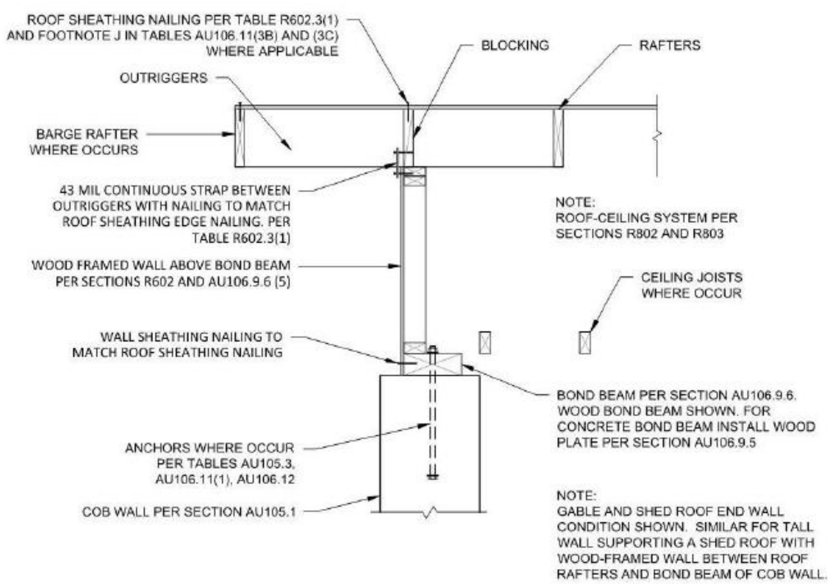
   3.3. Not less than nominal 6x12 (152 mm by 305 mm) or 4x16 (102 mm by 406 mm) for wall lengths ≤ 20 feet (6096 mm) in Seismic Design Category C.

   3.4 Corners shall be connected in accordance with Section AU106.9.3.

4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B, and C and for ultimate design wind speeds ≤ 140 mph (63.6 m/s).

5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602. The ratio of its largest height to its length shall not exceed 1:2. The wall shall contain no openings.

Figure AU106.9.6 Connections At Gable And Shed Roof End Walls



AU106.11.1 Non-orthogonal braced wall panels. *Braced wall panels* at an angle to the orthogonal braced wall lines shall be considered to contribute to the minimum total braced wall lengths in Tables AU106.11(2) , ~~and~~ AU106.11(3 A) , AU106.11(3B), and AU106.11(3C) as follows:

1. A braced wall panel not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50% of its length to that line.
2. A braced wall panel not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A braced wall panel greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved braced wall panel to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved *cob* walls shall contain two braced wall lines in two orthogonal directions. The spacing of the braced wall lines for wind design in Table AU106.11(2) and the spacing and length of the braced wall lines for seismic design in Table s AU106.11(3 A), AU106.11(3B) and AU106.11(3C) shall be the maximum widths of the building in the two orthogonal directions.

TABLE AU106.11(2) BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED

• EXPOSURE CATEGORY B[d] • 25-FOOT MEAN ROOF HEIGHT • 10-FOOT EAVE-TO-RIDGE HEIGHT[d] • 10-FOOT WALL HEIGHT[d] • 2 BRACED WALL LINES[d]			MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d]			
Ultimate Design Wind Speed (mph)	**Story Location**	**Braced Wall Line Spacing (feet)**	**Cob braced wall panel[e] A (aspect ratio H:L ≤ 1:1)**	**Cob braced wall panel[e] B (aspect ratio H:L ≤ 1:1)**	**Cob braced wall panel[e] C, D (aspect ratio H:L ≤ 2:1)**	**Cob braced wall panel[e] E (aspect ratio H:L ≤ 1:1)**

~~10~~ ≤ 110	~~6.0~~ One-story building	~~6.0~~ 10	~~3.7~~ 6.0	~~NP~~ 6.0	3.7	6.0
≤ 110	One-story building	20	7.9	7.4	7.4	~~NP~~ 6.0
~~30~~ ≤ 110	~~11.8~~ One-story building	~~11.0~~ 30	~~11.0~~ 11.8	~~NP~~ 11.0	11.0	6.9
~~10~~ ≤ 115	~~6.0~~ One-story building	~~6.0~~ 10	~~4.1~~ 6.0	~~NP~~ 6.0	4.1	6.0
≤ 115	One-story building	20	8.7	8.1	8.1	~~NP~~ 6.0
~~30~~ ≤ 115	~~13.0~~ One-story building	~~12.1~~ 30	~~12.1~~ 13.0	~~NP~~ 12.1	12.1	7.6
~~10~~ ≤ 120	~~6.0~~ One-story building	~~6.0~~ 10	~~4.4~~ 6.0	~~NP~~ 6.0	4.4	6.0
≤ 120	One-story building	20	9.4	8.8	8.8	~~NP~~ 6.0
~~30~~ ≤ 120	~~14.1~~ One-story building	~~13.1~~ 30	~~13.1~~ 14.1	~~NP~~ 13.1	13.1	8.3
~~10~~ ≤ 130	~~6.0~~ One-story building	~~6.0~~ 10	~~5.1~~ 6.0	~~NP~~ 6.0	5.1	6.0
≤ 130	One-story building	20	11.0	10.3	10.3	~~NP~~ 6.5
~~30~~ ≤ 130	~~16.5~~ One-story building	~~15.4~~ 30	~~15.4~~ 16.5	~~NP~~ 15.4	15.4	9.7
~~10~~ ≤ 140	~~6.0~~ One-story building	~~6.0~~ 10	~~5.9~~ 6.0	~~NP~~ 6.0	5.9	6.0
≤ 140	One-story building	20	12.7	11.9	11.9	~~NP~~ 7.5
~~30~~ ≤ 140	~~19.1~~ One-story building	~~17.8~~ 30	~~17.8~~ 19.1	~~NP~~ 17.8	17.8	11.2

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

a. Linear interpolation shall be permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2)

e. *Cob* braced wall panel types indicated shall comply with Sections AU106.11.1, AU106.11.2 and Table AU106.11(1).

TABLE AU106.11(3A) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A

• SOIL CLASS D[~~e~~f] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY A • 1.5" PLASTER THICKNESS EACH SIDE[~~h~~g]				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]		
Braced wall line spacing (feet)	**Braced wall line length (feet)**	**Min. Braced wall line % openings**	**Min. Perpendicular braced wall line % openings**	**Cob-braced wall panel[e] A, B**	**Cob-braced wall panel[e] C, D**	**Cob-braced wall panel[e] E**
10	30	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~	~~Wind[i]~~ 3.4	~~NP~~ 6.0
20	20	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~	~~Wind[i]~~ 3.5	~~NP~~ 6.0
20	30	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~	4.5	~~NP~~ 6.0
30	30	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~	~~Wind[i]~~ 5.6	~~NP~~ 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Section~~s~~ AU106.11~~.1 and AU106.11.2~~ and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *International Building Code*.

~~g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~

~~h~~ g. For total plaster thickness between 3-inches and 6-inches, the minimum total length of braced wall panels shall be mulitplied by 1.2.

~~i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).~~

AU106.11(3B) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B

• SOIL CLASS D[~~e~~f] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY B • 1.5" PLASTER THICKNESS EACH SIDE[~~h~~g]	MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]

Braced wall line spacing (feet)	Braced wall line length (feet)	Min. Braced wall line % openings	Min. Perpendicular braced wall lines % openings	Cob-braced wall panel[e] A, B	Cob-braced wall panel[e] C, D	Cob-braced wall panel[e] E
10	10	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~ 6.0	~~Wind[i]~~ 3.2	~~NP~~ 6.0
10	20	0	~~Any %[g]~~ 0	6.0	4.9	~~NP~~ 6.0
10	20	50	~~Any %[g]~~ 0	6.0	~~Wind[i]~~ 3.5	~~NP~~ 6.0
10	30	0	~~Any %[g]~~ 0	7.1	6.6	~~NP~~ 6.0
10	30	50	~~Any %[g]~~ 0	6.0	4.5	~~NP~~ 6.0
20	10	0	0	6.0[~~i~~h]	4.9[~~i~~h]	~~NP~~ 6.0
20	10	0	50	6.0	~~Wind[i]~~ 3.5	~~NP~~ 6.0
20	10	50	~~Any %[g]~~ 0	~~6.0~~ NP	4.2	NP
20	10	50	50	~~6.0~~ NP	~~4.2~~ 3.0	NP
20	20	0	0	7.4	6.9	~~NP~~ 6.0
20	20	0	50	6.0	5.5	~~NP~~ 6.0
20	20	50	0	6.0	5.5	~~NP~~ 6.0
20	20	50	50	6.0	4.1	~~NP~~ 6.0
20	30	0	0	9.4	8.8	~~NP~~ 6.0
20	30	0	50	7.9	7.4	~~NP~~ 6.0
20	30	50	0	7.2	6.7	~~NP~~ 6.0
20	30	50	50	6.0	5.3	~~NP~~ 6.0
30	10	~~Any %[g]~~ 0	~~Any %[g]~~ 0	~~Wind[i]~~ 7.1	~~Wind[i]~~ 6.6	~~NP~~ 6.0
30	20	0	0	9.4	8.8	~~NP~~ 6.0
30	20	0	50	~~Wind[i]~~ 7.2	~~Wind[i]~~ 6.7	~~NP~~ 6.0
30	20	50	~~Any %[g]~~ 0	7.9	~~Wind~~ 7.4	~~NP~~ 6.0
30	30	0	0	11.8	11.0	~~NP~~ 6.0
30	30	0	50	9.5	8.9	~~NP~~ 6.0
30	30	50	0	9.5	8.9	~~NP~~ 6.0
30	30	50	50	~~Wind[i]~~ 7.3	~~Wind[i]~~ 6.8	~~NP~~ 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4)

e. Cob braced panel types indicated shall comply with Section~~s~~ AU106.11~~.1, AU106.11.2~~ and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class "D." Interpolation of bracing lengths between *Sds* values associated with the seismic design categories is allowable where a site-specific *Sds* value is determined in accordance with Section 1613.3 of the *International Building Code*.

~~g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~

~~h.~~ g. For total plaster thicknesses 3-inches to 6-inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

~~i. The minimum total braced wall panel length shall be governed by Table AU106.11(2).~~

~~j.~~ h. Total plaster thicknesses shall be not greater than 3-inches. Substitute 15/32” roof sheathing and 10d at 6” edge nailing for requirements in Table R602.3(1).

AU106.11(3C) BRACING REQUIREMENTS FOR COB-BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C

• SOIL CLASS D[~~e~~f] • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AS106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD[d] • STORY LOCATION: ONE-STORY BUILDING • SESIMIC DESIGN CATEGORY C • 1.5” PLASTER THICKNESS EACH SIDE[~~h~~g]				MINIMUM TOTAL LENGTH (FEET) OF COB- BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a, b, c, d, e]		
Braced wall line spacing (feet)	**Braced wall line length (feet)**	**Min. Braced wall line % openings**	**Min. Perpendicular braced wall lines % openings**	**Cob-braced wall panel[e] A, B**	**Cob-braced wall panel[e] C, D**	**Cob-braced wall panel[e] E**
10	10	0	0	8.3[~~i~~h]	7.8[~~i~~h]	~~NP~~ 6.0
10	10	0	50	6.5	6.1	~~NP~~ 6.0
10	10	25	0	7.4[~~i~~h]	6.9[~~i~~h]	~~NP~~ 6.0
10	10	50	50	~~4.7~~ NP	4.4	~~NP~~ 6.0
10	15	0	0	10.6	9.9	~~NP~~ 6.0
10	15	0	50	8.7	8.2	~~NP~~ 6.0
10	15	50	0	~~7.8~~ NP	7.3	~~NP~~ 6.0
10	15	50	50	6.0	5.6	~~NP~~ 6.0
10	20	0	0	12.8	11.9	~~NP~~ 6.0
10	20	0	50	11.0	10.2	~~NP~~ 6.0
10	20	50	0	9.1	8.5	~~NP~~ 6.0
10	20	50	50	7.3	6.8	~~NP~~ 6.0
15	10	25	0	~~9.6~~ NP	~~9.0~~ NP	~~NP~~ 6.0[h]
15	10	0	50	7.8	7.3	~~NP~~ 6.0
15	10	50	0	~~8.7~~ NP	~~8.2~~ NP	NP
15	10	50	50	~~6.0~~ NP	~~5.6~~ NP	NP
15	15	0	0	12.9	12.1	~~NP~~ 6.0
15	15	0	50	10.2	9.5	~~NP~~ 6.0
15	15	50	0	~~10.2~~ NP	~~9.5~~ NP	~~NP~~ 6.0
15	15	50	50	7.5	7.0	~~NP~~ 6.0
15	20	0	0	15.3	14.3	~~NP~~ 6.0
15	20	0	50	12.6	11.7	~~NP~~ 6.0
15	20	50	0	~~11.7~~ NP	~~10.9~~ NP	~~NP~~ 6.0
15	20	50	50	8.9	8.3	~~NP~~ 6.0
20	10	25	0	NP	NP	NP
20	10	0	50	9.1	8.5	~~NP~~ 6.0
20	10	50	~~Any %[g]~~ 0	NP	NP	NP
20	10	50	50	~~7.3~~ NP	~~6.8~~ NP	NP
20	15	0	0	NP	~~NP~~ 14.3[h]	~~NP~~ 6.0[h]
20	15	0	50	11.7[~~i~~h]	10.9[~~i~~h]	~~NP~~ 6.0
20	15	50	0	NP	NP	~~NP~~ 6.0[h]

20	15	50	50	~~8.9[i]~~ NP	~~8.3[i]~~ NP	~~NP~~ 6.0
20	20	0	0	~~NP~~ 17.8	~~NP~~ 16.7	~~NP~~ 6.9
20	20	0	50	14.2	13.3	~~NP~~ 6.0
20	20	50	0	NP	NP	~~NP~~ 6.0
20	20	50	50	NP	9.9	~~NP~~ 6.0

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted

a. Interpolation is not permitted.

b. Braced wall panels shall be without openings.

c. Braced wall panel types A, B and E shall have an aspect ratio (H:L) ≤ 1:1. Braced wall panel types C and D shall have an aspect ratio (H:L) ≤ 2:1.

d. Subject to applicable seismic adjustment factors associated with item 5 in Table R602.10.3(4).

e. Cob braced panel types indicated shall comply with Section~~s~~ AU106.11~~.1, AU106.11.2~~ and Table AU106.11(1).

f. Wall bracing lengths are based on a soil site class “D.” Interpolation of bracing lengths between *Sds* values associated with the seismic design categories is allowable where a site-specific *Sds* value is determined in accordance with Section 1613.3 of the *International Building Code*.

~~g. Openings in the braced wall line shall not be limited, except that the minimum total braced wall panel length shall be as determined by Tables AU106.11(3A) and AU106.11(2).~~

~~h.~~ g. For total plaster thicknesses 3” to 6”, multiply the minimum total length of braced wall panels by 1.2.

~~i.~~ h. Total plaster thickness > 3” is not permitted. Substitute 15/32” roof sheathing and 10d at 6” edge nailing for requirements in Table R602.3(1).

AU108.1 Fire-resistance rating. *Cob* walls ~~shall be considered to exhibit a 1-hour~~ are not fire-resistance rated.~~rating in accordance with the following:~~

1. ~~Wall thickness shall be 10 inches (254 mm) or greater.~~
2. ~~Density shall be 70 pcf (1121 kg/m^3) or greater.~~
3. ~~When used as a *load-bearing wall*, the maximum design load shall be 1000 pounds per lineal foot (14,590 N/m) in accordance with Section AS106.8.~~
4. ~~When used as a *braced wall panel*, the wall shall be in accordance with Section AS106.11.~~

Commenter's Reason: This public comment does the following:

- Removes the fire-resistance rating for cob walls in the original proposal because a full ASTM E119 test to justify the rating had not been conducted. This addresses the primary reason for the IRC Committee's disapproval of the proposal.
- Incorporates the 3 Floor Modifications that were accepted and approved by the IRC Committee. These include a) reducing the maximum building height from 25' to 20', b) incorporating a Figure showing the structurally important top of wall to roof connection, and c) correcting braced wall panel lengths in Table AU106.11(3C) because of discoveries made between the original submittal and the IRC Committee Hearings.
- Adds a Figure showing structural connections for gable and shed roof end walls, based on input from two stakeholders subsequent to the IRC Committee Hearings.
- Adds braced wall panel lengths in four tables for Wall E. These values were not in the original proposal because the University testing results were not available at the time of submittal. They became available in time for this public comment.
- Adds language in Section AU104.1 to ensure compliance with sections of the code regarding fire-related requirements for interior finishes, as identified in testimony for a similar proposal.
- Corrects section number errors.

Together these modifications significantly improve the proposal, and address the IRC Committee's written comments and comments spoken during testimony at the IRC Committee Hearings.

There are two reasons the proposed IRC Appendix on Cob Construction (Monolithic Adobe) is urgently needed:

First, people are building unpermitted unsafe buildings with cob, including in high seismic zones, often after discovering how difficult it is to permit cob buildings because there is no cob building code.

Second, the increasing frequency and intensity of wildfires, especially in western states, is motivating elected officials, building officials, firefighters, design professionals, the insurance industry, homeowners, and entire communities to actively seek highly fire resistant building systems. Cob construction provides a very high level of fire resistance, as evidenced by the performance of cob and adobe buildings in intense Australian bush fires, and by related testing and research. Cob has been used for centuries to construct ovens and kilns. See the original proposal's Reason Statement for more on cob's exceptional fire resistance qualities.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As a wall system, cob can be more costly or less costly than conventional wall systems found in the IRC, depending on many variables. The materials for cob walls - clay-soil (often from the site), sand, and straw - are relatively inexpensive whereas the cob walls can be more labor intensive. Other elements or systems in the building such as the foundation, roof, electrical, plumbing and mechanical are typically similar to those used in conventional construction and therefore the same cost. Overall, this proposal and its public comment revisions will not affect the cost of construction.

Public Comment# 1611

RB300-19

IRC®: Appendix U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), SECTION AU102 (New), AU102.1 (New), AU102.1.1 (New), AU102.1.2 (New), AU102.1.3 (New), AU102.1.4 (New), AU102.1.5 (New), SECTION AU103 (New), AU103.1 (New), AU103.1.1 (New), AU103.1.2 (New), SECTION AU104 (New), AU104.1 (New), SECTION AU105 (New), AU105.1 (New), AU105.1.1 (New), AU105.1.2 (New), AU105.1.3 (New), AU105.1.4 (New), AU105.1.5 (New), SECTION AU106 (New), AU106.1 (New)

Proposed Change as Submitted

Proponents: Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (Eirene.Knott@brrarch.com); David Allen, representing Edward Wayne Inc. (davidallen89@att.net); Ron Olberding, representing Edward Wayne Inc. (ronolberding@sbcglobal.net)

2018 International Residential Code

Add new text as follows:

Appendix U
Physical Security

SECTION AU101
General

AU101.1 Purpose. The purpose of this appendix is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

AU101.2 Scope. The provisions of this appendix shall apply to all new structures and to additions and alterations made to existing buildings.

SECTION AU102
Doors

AU102.1 Doors. All exterior swinging doors of residential dwelling units and attached garages, including doors leading from the garage area into the dwelling unit, shall comply with Sections AU102.1.1 through AU102.1.5 based on the type of door installed.

Exceptions: Vehicular access doors.

AU102.1.1 Wood doors. Exterior wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.

AU102.1.2 Steel doors. Exterior steel doors shall be a minimum thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

AU102.1.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

AU102.1.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the door frame, or by other approved methods.

AU102.1.5 Sliding doors. Exterior sliding doors shall be installed to prevent the removal of the panels and the glazing from the exterior.

SECTION AU103
Door Frames

AU103.1 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Horizontal blocking shall be placed between studs at the door lock height for three stud spaces of equivalent bracing on each side of the door opening. Door frames shall comply with Sections AU103.1.1 through AU103.1.2 based on the type of door installed.

AU103.1.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelights, shall be reinforced in accordance with ASTM F476 Grade 40.

AU103.1.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel and reinforced at the hinges and strikes. Doors are to be anchored to the wall in accordance with the manufacturer's instructions.

SECTION AU104
Door Jambs

AU104.1 Door jambs. Door jambs shall comply with one of the following:

1. Door jambs constructed as per ASTM F476.
2. Door stops on wooden jambs for in-swinging doors shall be of one-piece construction.

SECTION AU105
Door Hardware

AU105.1 Door hardware. Exterior door hardware shall comply with Sections AU105.1.1 through AU105.1.5.

AU105.1.1 Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure shall be used. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

AU105.1.2 Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's interior side.

AU105.1.3 Locks. Exterior doors shall be provided with a deadbolt with a minimum grade 2 as determined by ANSI/BHMA.

AU105.1.4 Entry vision and glazing. All main or front entry doors to dwelling units shall be arranged so that the occupant has a view of the area immediately outside the door without opening the door. The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.

AU105.1.5 Side light entry doors. Side light doors units shall have framing of double stud construction or equivalent construction that complies with Sections AU103.1.1 or AU103.1.2. Double stud construction or equivalent construction shall exist between the glazing unit of the side light and the wall structure of the dwelling.

SECTION AU106
Alternate Materials and Methods of Construction

AU106.1 Alternate materials and methods of construction. The provisions of this appendix are not intended to prevent the use of any material or method of construction not specifically prescribed by this appendix, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this appendix. The materials, method of construction and structural design limitations provided for in this appendix shall be used unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this appendix.

Reason: In the summer of 1996, Overland Park, Kansas, experienced a series of home invasions resulting in the sexual assault of several women. For the victims of a home invasion, it's more than a property crime; it scares the victim into thinking that the criminal will return only to commit a more violent or heinous crime. To have an emotional investment in their residence is priceless.
As a result of these home invasions, the City's Police Department conducted hundreds of surveys of residents in an effort to develop a solution to the home invasions. The results of the surveys lead the City to develop a building code that makes home more safe and secure. You may ask, why secure the front door? What about installing an alarm? Communities across the country continue to report a growing increase in false alarms. In an effort to provide physical security to the homeowner, there needs to be a more reliable option available.

The longer a criminal spends trying to gain access to a home, the greater the risk of detection. In addition, most home invaders will not attempt to break a window, as that makes noise that neighbors could potentially hear. Rather than face these risks, the invader is more likely to try to kick in an exterior door, where they can easily gain access without being detected.

This code change will provide for minimal provisions to be made to a new home under construction that will give the homeowner safety and peace of mind, while delaying and frustrating the criminal. Since this proposal is not dependent on electrical power, these provisions will always be available to the homeowner and will require no further action after installation. There is no on-going cost to the homeowner and these provisions will not affect the overall aesthetics of the home.

Cost Impact: The code change proposal will increase the cost of construction
The cost to secure a single door ranges from $40-$60 for a single door unit and between $140 and $180 for a double sidelite unit.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F476 and ANSI/BHMA, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB300-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This should be an appendix, but it still needs work, as indicated in the committee's reason for disapproval of RB161-19. (Vote: 9-2)

Assembly Action: **None**

RB300-19

Individual Consideration Agenda

Public Comment 1:

IRC®: Appendix U (New), SECTION AU101 (New), AU101.1 (New), AU101.2 (New), SECTION AU102 (New), AU102.1 (New), AU102.1.1 (New), AU102.1.2 (New), AU102.1.3 (New), AU102.1.4 (New), AU102.1.5 (New), SECTION AU103 (New), AU103.1 (New), AU103.1.1 (New), AU103.1.2 (New), AU103.1.3 (New), SECTION AU104 (New), AU104.1 (New), SECTION AU104 (New), AU104.1 AU105.1 (New), AU104.1.1 (New), AU104.1.2 (New), AU104.1.3 (New), AU104.1.4 (New), SECTION AU106 (New), AU106.1 (New), ANSI Chapter 44 (New), ASTM Chapter 44 (New)

Proponents:
Eirene Knott, representing Metropolitan Kansas City Chapter of the ICC (eirene.knott@brrarch.com); Ron Olberding, representing Edward Wayne (ronolberding@sbcglobal.net); David Allen, Edward Wayne Inc., representing Edward Wayne (davidallen89@att.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

Appendix U
Physical Security

SECTION AU101
General

AU101.1 Purpose. The purpose of this appendix is to establish minimum standards that incorporate physical security to make dwelling units resistant to unlawful entry.

AU101.2 ~~Scope~~ Application. The provisions of this appendix shall apply to all new structures and to additions and alterations made to existing buildings as provided for in Section R102.7.1.

SECTION AU102
DOORS

AU102.1 Doors. All exterior ~~swinging~~ doors , ~~of residential dwelling units and attached garages, including~~ and doors leading from the garage area into the dwelling unit, shall comply with Sections AU102.1.1 through AU102.1.5 based on the type of door installed.

Exceptions:

1. Vehicle access doors
2. Storm or screen doors

AU102.1.1 Wood doors. ~~Exterior w~~ Wood doors shall be of solid core construction such as high-density particleboard, solid wood, or wood block core with a minimum thickness of 1-3/4 inches (45 mm) where measured at the locking device or hinge. ~~at any point. Doors with panel inserts shall be solid wood with the insert being a minimum of 1-inch (25.4 mm) in thickness.~~

AU102.1.2 Steel doors. ~~Exterior s~~ Steel doors shall be a minimum skin thickness of 24 gauge and have reinforcement material at the location of the deadbolt.

AU102.1.3 Fiberglass doors. Fiberglass doors shall have a minimum skin thickness of one-sixteenth inch and have reinforcement material at the location of the deadbolt.

AU102.1.4 Double doors. The inactive leaf of an exterior double door shall be provided with flush bolts having an engagement of not less than 1-inch (25.4 mm) into the head and threshold of the door frame, or by other approved methods.

AU102.1.5 Sliding doors. ~~Exterior s~~ Sliding doors shall be installed to prevent the removal of the panels ~~and the glazing~~ from the exterior.

SECTION AU103
DOOR FRAMES

AU103.1 Door frames. The exterior door frames shall be installed prior to the rough-in inspection. Two-inch nominal wood ~~Horizontal~~ blocking shall be placed horizontally between studs at the door lock height for at least one ~~three~~ stud space~~s of equivalent bracing~~ on each side of the door opening. Door frames shall comply with ATSM F476 Grade 40 for the bolt and hinge impact. Door frames shall comply with Sections AU103.1.1 through ~~AU103.1.2~~ AU103.1.3 based on the type of door installed.

AU103.1.1 Wood frames. Wood frame doors shall be set in frame openings constructed of double studding or equivalent construction. Door frames, including those with sidelites ~~lights~~, shall be reinforced ~~in accordance with ASTM F476 Grade 40~~.

AU103.1.2 Steel frames. Steel door frames shall be constructed of 18 gauge or heavier steel ~~and reinforced at the hinges and strikes~~. Doors ~~are to~~ shall be anchored to the wall in accordance with the manufacturer's instructions.

AU103.1.3 ~~AU105.1.5~~ Sidelite ~~light entry~~ entries ~~doors~~. Sidelite ~~light~~ door~~s~~ units shall have framing of double stud construction or equivalent construction ~~that complies with Sections AU103.1.1 or AU103.1.2~~. Double stud construction or equivalent construction shall exist between the glazing unit of the side lite ~~light~~ and the wall structure of the dwelling.

~~SECTION AU104~~
~~Door Jambs~~

~~**AU104.1 Door jambs.** Door jambs shall comply with one of the following:~~

1. ~~Door jambs constructed as per ASTM F476.~~
2. ~~Door stops on wooden jambs for in-swinging doors shall be of one-piece construction.~~

SECTION AU104 ~~AU105~~
DOOR HARDWARE

AU104.1 AU105.1 Door hardware. Exterior door hardware shall comply with Sections AU104.1.1 ~~AU105.1.1~~ through AU104.1.4 ~~AU105.1.4~~.

AU104.1.1 ~~AU105.1.1~~ Hinges. Hinges for exterior swinging doors shall comply with the following:

1. At least two screws, 3 inches (76 mm) in length, penetrating at least 1-inch (25.4 mm) into the wall structure ~~shall be used~~. Solid wood fillers or shims shall be used to eliminate any space between the wall structure and the door frame behind each hinge.
2. Hinges for out-swinging doors shall be equipped with mechanical interlock to prevent removal of the door from the exterior.

Exception: Sidelite doors complying with ASTM F476 for the bolt and hinge impact test.

AU104.1.2 ~~AU105.1.2~~ Escutcheon plates. All exterior doors shall have escutcheon plates protecting the door's edge at the location of the deadbolt ~~interior side~~.

AU104.1.3 ~~AU105.1.3~~ Locks. Exterior doors shall be provided with a deadbolt with a minimum grade ~~2~~ B as determined by ANSI/BHMA A156.40.

AU104.1.4 ~~AU105.1.4~~ Entry vision and glazing. ~~All main or f~~ Front entry doors to dwelling units shall be arranged so that the occupant has a 180 degree view of the area immediately outside the door without opening the door. ~~The view may be provided by a door viewer having a field of view of not less than 180 degrees, through windows or through view ports.~~

~~SECTION AU106~~
~~Alternate Materials and Methods of Construction~~

~~**AU106.1 Alternate materials and methods of construction.** The provisions of this appendix are not intended to prevent the use of any material or method of construction not specifically prescribed by this appendix, provided any such alternate has been approved. Nor is it the intention of this section to exclude any sound method of structural design or analysis not specifically provided for in this appendix. The materials, method of construction and structural design limitations provided for in this appendix shall be used unless otherwise approved. Compliance with ASTM F476 will be deemed to be in compliance with this appendix.~~

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York NY 10036

A156.40: **American National Standard for Residential Deadbolts**

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428

F476: **Standard Test Methods for Security of Swinging Door Assemblies**

Commenter's Reason: The changes here reflect concerns and comments expressed from the committee for their decision on RB 161. The committee agreed this language belongs in the Appendix so the items presented in this public comment should address the concerns expressed by the committee members as well as others who spoke in opposition at the committee hearings.

One of the concerns the committee expressed was that this code change goes beyond the minimum requirements of the IRC. Per Section R101.3, the purpose of the IRC is to safeguard the public safety in general as well as for safety to life and property from fire and other hazards attributed to the built environment. How is protecting the occupants of a home from unwanted physical entry not providing a minimum level of protection for the public safety?

Another concern expressed by the committee was that the building code is not a crime prevention code. We agree with the committee. However, the code does address life safety, which is what we believe this code change covers.

One of the committee members expressed concerns about window opening requirements and that someone wanting entry would enter through the window. This code change is not about windows so we're not sure what the committee's concern was regarding windows. The FBI Uniform Crime Report shows that the majority of break-ins occur through an exterior door, which is what this code change is addressing.

Another committee comment was that this language is commentary. This code change includes code language, so we're not sure what the committee meant by that as commentary is generally language defining the code requirements.

In regards to the statement made by the committee about a false sense of security, current construction practices technically give a false sense of security as there are no requirements for any sense of security to a home owner in the current IRC. If someone wants to break into a home, they will find a way to do so. Much like a smoke detector provides the homeowner ample time to respond to a possible fire, this code change is an attempt to provide the homeowner ample time to respond to an attempted break-in.

What helps to prevent crime is witness potential. By delaying the potential entry into a home, the probability of a witness increases. Whether you live in a rural or urban environment, this code change provides the homeowner ample time to respond.

We believe that we have addressed concerns expressed by not only the committee but others who spoke in opposition with the language presented in this public comment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost to secure a single door ranges from $40-60 for a single door unit and between $140-180 for a double sidelite unit.

Public Comment# 1384

RB301-19

IRC: APPENDIX U(New)

Proposed Change as Submitted

Proponents: Deck Code Coalition, Charles Bajnai (chair), North American Deck and Railing Assoc (NADRA), representing Deck Code Coalition (csbajnai@gmail.com)

2018 International Residential Code

Add new text as follows:

APPENDIX U
DECK GUARD DETAILS

SECTION AU101
GENERAL

AU101.1 Deck guards. Figures AU101.1(1) and AU101.1(2) are prescriptive options for deck guard, wood post connections to deck framing.

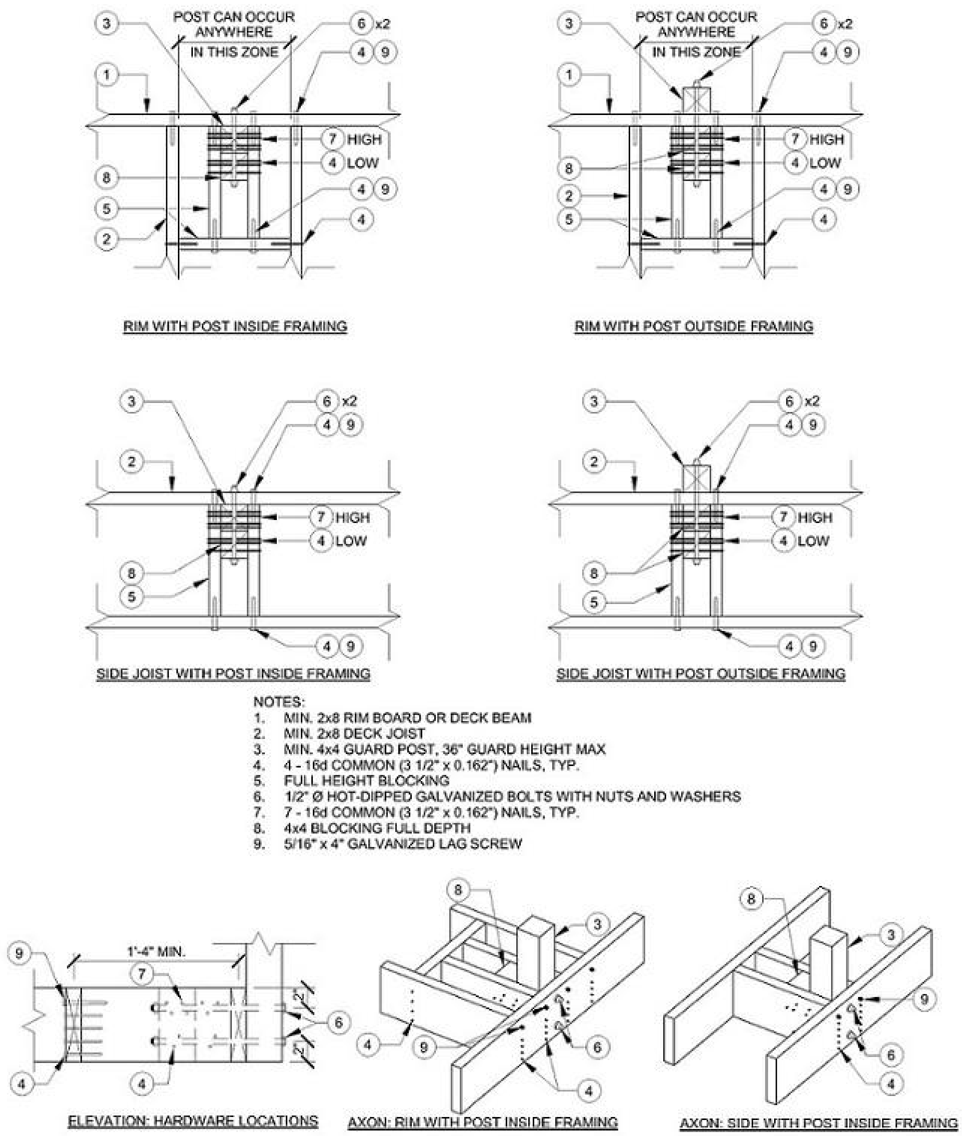


FIGURE AU1
GUARD POST CONNECTIONS WITH COMMODITY FASTENERS

UA101.1(1)
GUARD POST CONNECTION WITH COMMODITY FASTENERS

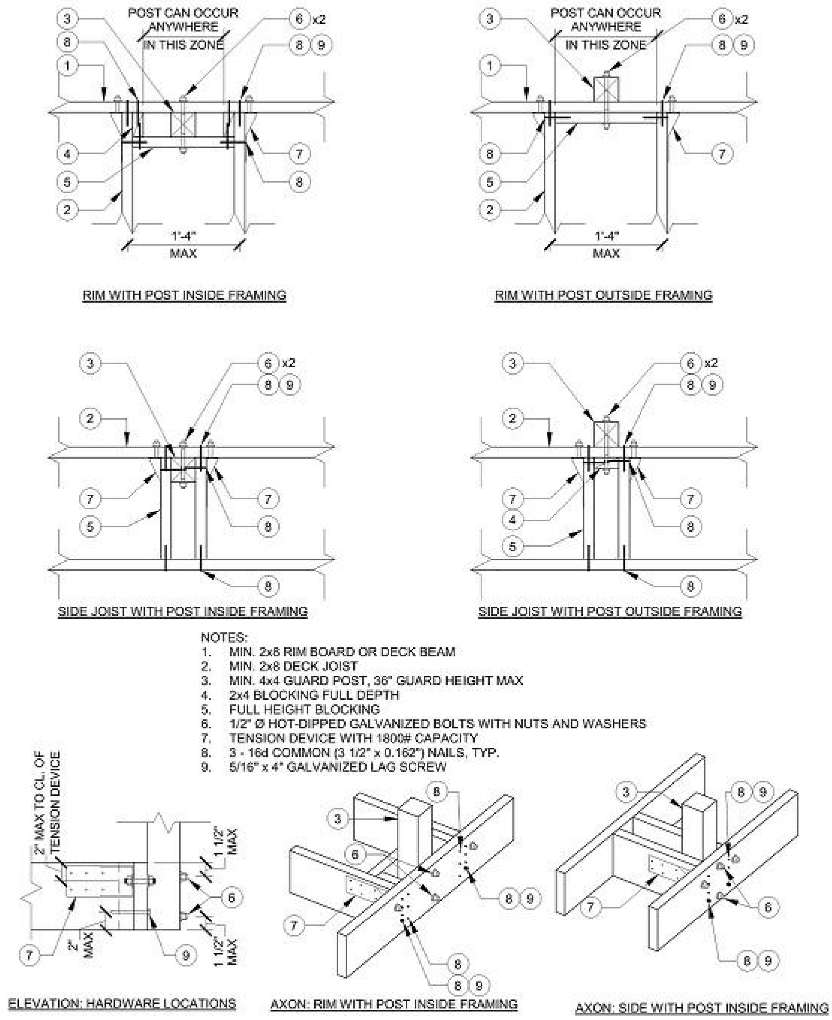


FIGURE AU2
GUARD POST CONNECTIONS WITH TENSION DEVICES

AU2
GUARD POST CONNECTIONS WITH TENSION DEVICE

Reason: The Deck Code Coalition (DCC) proposes a new appendix to offer direction for constructing exterior guards on decks where the code is currently silent.
The members of the DCC recognize that there are many methods for constructing guards, and that the inclusion of a single detail within the body of the code may restrict creativity in the building community. However, there are many people building, specifying, and reviewing decks that are eager for guidance with the complicated connection that is required for connecting deck guard posts to deck framing. Providing a prescriptive detail in an appendix allows us to provide the guidance of an engineered solution that meets the intent of the code.

Homeowners need these details. Empirical evidence shows us that over fifty percent of the decks constructed in the country are built by the homeowners themselves. These details might not be the typical by professional, customized deck builders, but they will be infinitely valuable for the homeowner who has little or no construction knowledge, does not want to pay for design services and will build one deck in his/her lifetime. Without prescriptive details, they will either resort to friends, YouTube or other sources, such as DCA6, for guidance. They say, “just show me how you want it, and I will build it that way”.

Building officials need these details. Short of having every deck design tested in a lab or sealed by an engineer, there is not a building official who knows if the guards pass muster. The hip check is not a proper testing method. These details are a minimum engineered design which they can look for if they have no other evidence of code compliance.

Cost Impact: The code change proposal will increase the cost of construction
Two figures are offered. One figure offers generic, cheap fastening techniques of nails and bolts into blocking, the other figure uses proprietary

fasteners for about $20 per post (around $140 for a 144 square foot deck using 7 guard posts).

On the other hand, a savings of time and money could be anticipated for the conscientious homeowner who might pay a professional designer to prepare his deck drawings.

Any extra cost has to be weighed against the increased safety and potential life savings that will occur across the country over many years.

RB301-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal is inconsistent. It might be beneficial to reference back to where this is required. Details of each might add clarity. The committee encourages the proponents to bring the proposal back with the correct loading during the public comment period. (Vote: 8-3)

Assembly Action: **None**

RB301-19

Individual Consideration Agenda

Public Comment 1:

IRC®: AU101.1 (New), AU101.2 (New), FIGURE UA101.1(1) (New), FIGURE FIGURE AU101.1(2) (New), Add new Figure as follows FIGURE AU101.1(3) (New), FIGURE AU101.1(4) (New), FIGURE AU101.1(5) (New)

Proponents:
Charles Bajnai, representing Deck Code Coalition (csbajnai@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

AU101.1 ~~**Deck guards.**~~ **General.** Figures AU101.1(1) ~~and AU101.1(2)~~ through AU101.1(5) are prescriptive options for connecting wood deck guard ~~wood~~ posts ~~connections~~ to wood deck framing.

AU101.2 **Load assumptions.** Figures AU101.1(1) through AU101.1(5) are engineered to resist a 200 pound point load applied in accordance with Table R301.5 to a single, wood guard post in conformance with Section R507.10.1.

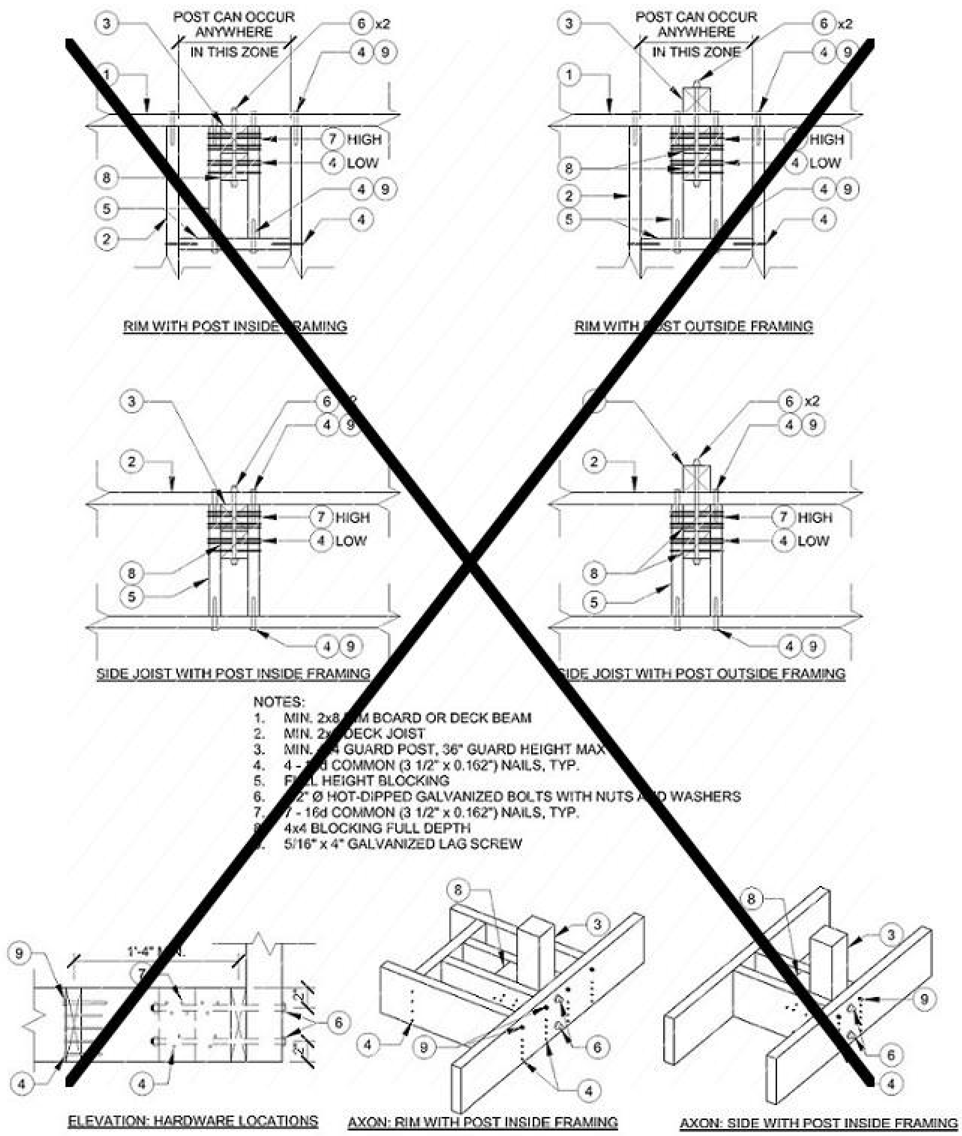
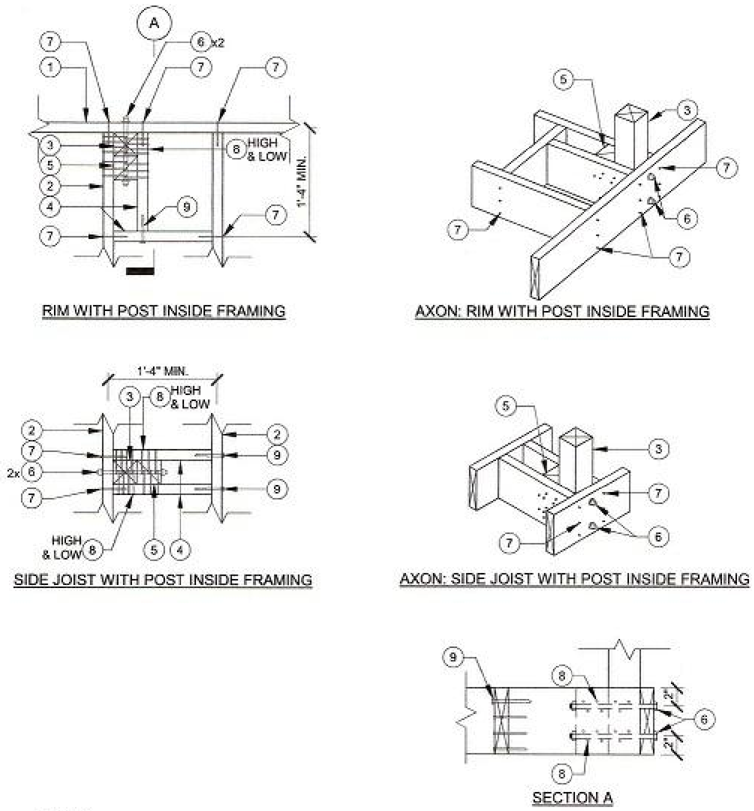


FIGURE AU1
GUARD POST CONNECTIONS WITH COMMODITY FASTENERS



NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. 4x4 BLOCKING FULL DEPTH
6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 7 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.

FIGURE UA101.1(1)
GUARD POST CONNECTION WITH COMMODITY FASTENERS

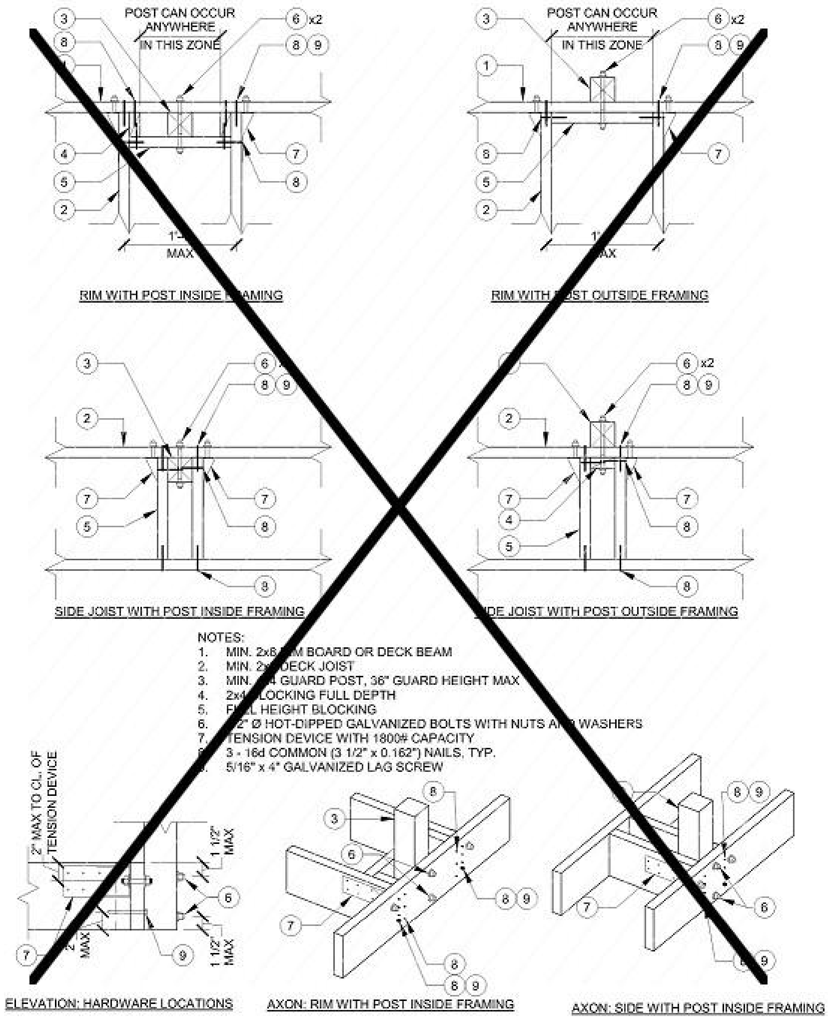
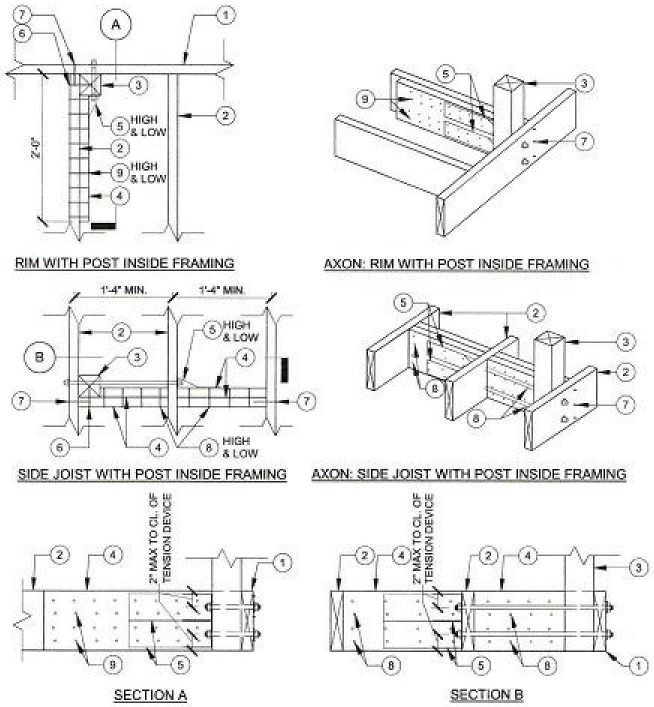
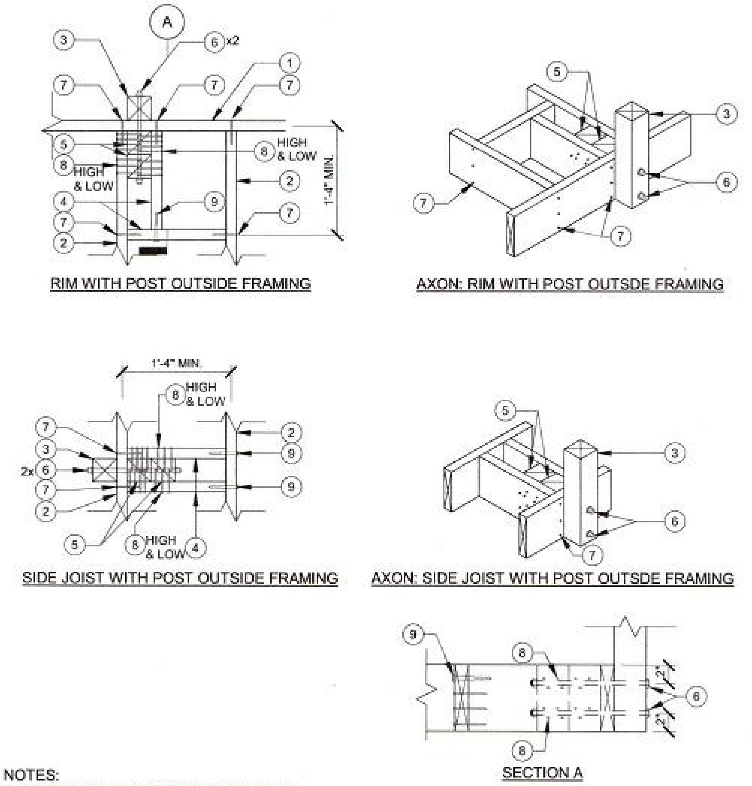


FIGURE AU2
GUARD POST CONNECTIONS WITH TENSION DEVICES



NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. TENSION DEVICE WITH 1800# CAPACITY. FASTENERS NOT SHOWN.
6. 2 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 8 - 10d COMMON (3" x 0.148") NAILS, BLOCKING-TO-BLOCKING TYP.
9. 16 - 10d COMMON (3" x 0.148") NAILS, BLOCKING-TO-JOIST TYP.
10. BOTTOM TENSION DEVICE REQUIRED FOR INWARD LOAD ON GUARD

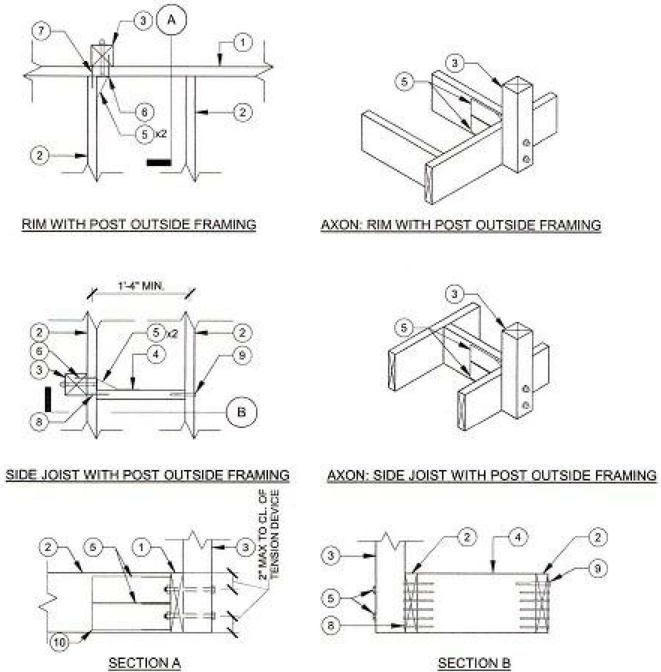
FIGURE AU101.1(2)
GUARD POST CONNECTIONS INSIDE FRAMING WITH TENSION DEVICE



NOTES:

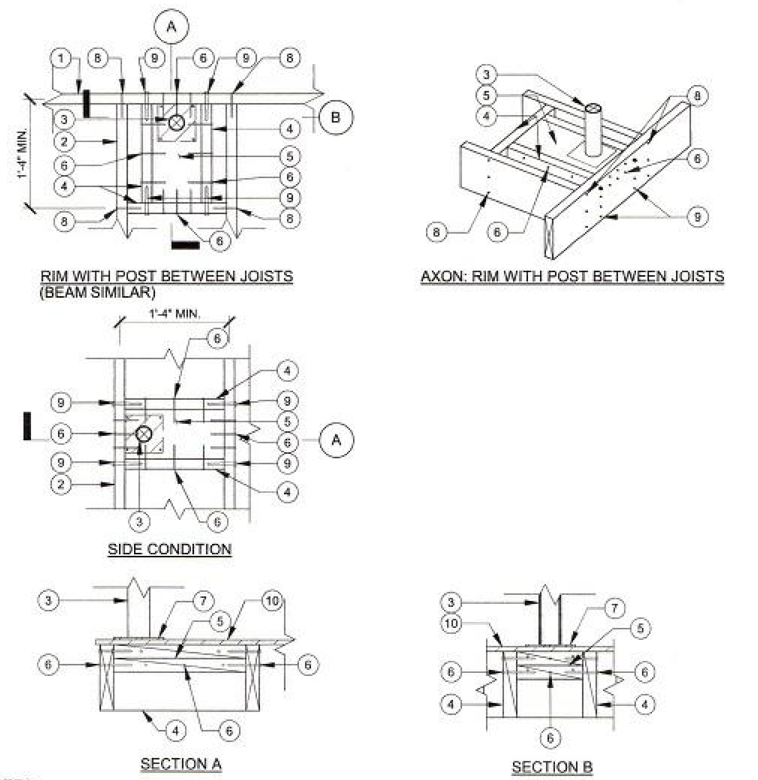
1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. 4x4 BLOCKING FULL DEPTH
6. 1/2" Ø HOT-DIPPED GALVANIZED BOLTS WITH NUTS AND WASHERS
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 7 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.

FIGURE AU101.1(3)
GUARD POST CONNECTIONS OUTSIDE FRAMING WITH COMMODITY FASTENERS



NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. MIN. 4x4 GUARD POST, 37" GUARD HEIGHT MAX
4. FULL HEIGHT BLOCKING
5. TENSION DEVICE WITH 1800# CAPACITY, FASTENERS NOT SHOWN
6. 2 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
7. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
8. 6 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW W/ 5 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
10. BOTTOM TENSION DEVICE REQUIRED FOR INWARD LOAD ON GUARD

FIGURE AU101.1(4)
GUARD POST CONNECTIONS OUTSIDE FRAMING WITH TENSION DEVICES



NOTES:
1. MIN. 2x8 RIM BOARD OR DECK BEAM
2. MIN. 2x8 DECK JOIST
3. TOP MOUNTED GUARD POST INSTALLED PER MANUFACTURER'S INSTRUCTIONS MOUNTED TO DECK FRAMING TYPICAL, 39" MAX HEIGHT
4. 2x VERTICAL BLOCKING, FULL DEPTH
5. (2) 2x8 LAID FLAT, INCREASE BLOCKING DEPTH TO ACCOMMODATE FULL EMBEDMENT OF MANUFACTURER'S REQUIRED CONNECTION HARDWARE.
6. 6 - 16d COMMON (3 1/2" x 0.162") NAILS, THROUGH 1-PLY RIM JOIST OR BLOCKING TYP.
7. (4) 10d NAILS FOR ATTACHING DECKING TO BLOCKING AT POST CONNECTION.
8. 3 - 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
9. 3/8" x 4" GALVANIZED LAG SCREW AND (3) 16d COMMON (3 1/2" x 0.162") NAILS, TYP.
10. DECKING MAX THICKNESS 1 1/2"

FIGURE AU101.1(5)
TOP MOUNTED GUARD POST CONNECTIONS WITH COMMODITY FASTENERS

Commenter's Reason: The committee acknowledged that prescriptive options for connecting wood guards to wood decks was needed by building officials and contractors across the country. They encouraged the Deck Code Coalition to revise the details to be in compliance with Table R301.5. The DCC listened to the committee and opposition testimony and engineered five new prescriptive options that meet the loading requirements in the approved code change RB85-19 for 200# in the four primary loading directions: up, down, in and out:

AU101.1(1) Posts attached to deck framing (interior of rim/beam) with commodity fasteners, i.e. nails

AU101.1(2) Posts attached to deck framing (interior of rim/beam) with tension fasteners

AU101.1(3) Posts attached to deck framing (exterior of rim/beam) with commodity fasteners

AU101.1(4) Posts attached to deck framing (exterior of rim/beam) with tension fasteners

AU101.1(5) Posts attached to the top of decking

This public comment intends to:

1. State that the details are optional and in compliance with Table R301.5

2. Are intended for wood guard posts and wood decks, and not intended for other materials.

3. And that the loading assumptions are based on the applied load bearing on a single post - not load-shared with other posts and/or connectors.

4. Include top mounted posts.

The Deck Code Coalition has worked extremely hard over these past few years to promote deck safety, provide easy to understand code language for the D-I-Y homeowner, and these prescriptive details satisfy these needs. We encourage to support this appendix so municipalities and jurisdictions across the country can use them.

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

Public Comment# 1670

RB302-19

IRC®: Appendix U (New), SECTION U101 (New), U101 (New), U102.1 (New), SECTION U103 (New), U103.1 (New), U103.2 (New), U103.3 (New), U103.4 (New), U103.5 (New), SECTION U104 (New), U104.1 (New), U104.2 (New), U104.3 (New), U104.4 (New), SECTION U105 (New), U105.1 (New), SECTION U106 (New), (New)

Proposed Change as Submitted

Proponents: Jonathan Roberts, UL LLC, representing UL LLC (jonathan.roberts@ul.com)

2018 International Residential Code

Add new text as follows:

Appendix U
3D PRINTED BUILDING CONSTRUCTION

SECTION U101
General

U101 Scope. Buildings and structures fabricated in whole or in part using 3D printed construction techniques shall be designed, constructed and inspected in accordance with the provisions contained in this Appendix and other applicable requirements in this code.

U102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

3D PRINTED BUILDING CONSTRUCTION. A process for fabricating buildings and structures from 3D model data using automated equipment that deposits construction material in a layer upon layer fashion.

ADDITIVE MANUFACTURING MATERIALS. Materials used by the 3D printer to produce the building structure or system components of the building.

PRODUCTION EQUIPMENT. The equipment, including 3D printer, its settings, nozzles and other accessories used in the fabrication process.

FABRICATION PROCESS. Preparation of the job site and construction material, and the deposition, curing, finishing, insertion of components and other methods used to build building elements such as walls, partitions, roof assemblies and structural components, and the means used to connect assemblies together.

SYSTEM COMPONENTS. Devices, equipment and appliances that are installed in the building elements as part of the wiring, plumbing, HVAC and other systems. These include, but are not limited to, electrical outlet boxes, conduit, wiring, piping, tubing, and HVAC ducts, each of which is covered by a product standard or Installation Code Requirement.

SECTION U103
Building Design

U103.1 Design organization. 3D printed buildings and structures shall be designed by an organization certified in accordance with UL 3401 by an approved agency and approved by the building official based on this section.

U103.2 Engineered design. The plans included in the UL 3401 compliance report shall be used for determining compliance with the engineering design requirements in Section R301.1.3 of this code.

U103.3 Performance design. The requirements in Chapters 4 through 9 and Chapter 11 of this code shall be waived where the UL 3401 compliance report demonstrates that the 3D printed construction provides an equivalent level of performance as the prescriptive code requirements.

U103.4 Other Equipment and Systems. Where not covered by the UL 3401 compliance report, the following provisions of this code shall be used as a basis for determining compliance for the following equipment and systems:

1. Chimneys and fireplaces – Part III, Chapter 10.
2. Energy efficiency – Part IV.
3. Mechanical – Part V.
4. Fuel gas – Part VI.
5. Plumbing – Part VII.
6. Electrical – Part VIII.

U103.5 Ratings The building or structure ratings in the UL 3401 compliance report, including but not limited to fire-resistance, interior finish, roofing fire classification, insulation material R-value shall be suitable for the installation. The acceptability of material and system ratings not included in the compliance report shall be determined by the building official.

SECTION U104
BUILDING CONSTRUCTION

U104.1 Construction. 3D printed buildings and structures shall be constructed in accordance with this section.

U104.2 Construction method. The building construction method, consisting of the manufacturer's *production equipment* and *fabrication process* shall be in accordance with the UL 3401 compliance report. The unique identifier of the construction method used shall match the identifier in the UL 3401 compliance report.

U104.3 Additive manufacturing materials. Only the listed additive manufacturing materials identified in the UL 3401 compliance report shall be used to fabricate the building structure or system components. Containers of the additive manufacturing materials shall be labeled.

U104.4 Depositing of manufacturing materials. Manufacturing materials shall only be deposited where ambient temperature and environmental conditions at the job site are within limits specified in the UL 3401 compliance report. The maximum number of layers permitted, specified curing time and any surface preparation or finishing shall be performed as specified in the UL 3401 compliance report.

SECTION U105
Special Inspections

U105.1 Initial inspection An initial inspection of the production equipment, including 3D printer, and the fabrication process shall be performed after the production equipment is located onsite and before building fabrication has begun. The inspection shall be conducted by representatives of the organization that evaluated the fabrication process for compliance with UL 3401. The inspection shall verify that the fabrications process, including production equipment, 3D printing parameters and construction materials are in accordance with the UL 3401 compliance report, and proprietary information in the UL 3401 detailed report of findings.

> **Exception:** Where approved by the building official, inspections of the production equipment, including 3D printer, and the fabrication process used in a single housing tract shall be conducted on the first building to be constructed, and on a selected number of subsequent buildings, where the same equipment, equipment operators and fabrication process are used on all buildings. The number of inspections to be performed shall be determined by the building official.

SECTION U106
REFERENCED STANDARDS

UL 3401-19 Outline of Investigation for 3D Printed Building Construction

Reason: 3D building construction has moved from a conceptual stage to reality, and projects are being proposed in an increasing number of jurisdictions. Unfortunately the prescriptive design and construction requirements in the IRC are not applicable to 3D printed fabrication techniques, so code officials have to approve this construction based on limited equivalency evaluations that may not take into account variations in material properties introduced by the 3D printing process, or variances in the physical characteristics of the construction materials used.
The UL 3401 Outline of Investigation for 3D Printed Building Construction was developed to evaluate critical aspects of this construction process, and level the playing field so that 3D printed building techniques comply with an equivalent level of safety and performance as legacy construction techniques currently in the code.

This proposal introduces an Appendix U, which is not mandatory unless specifically referenced in an adopting ordinance. The Appendix includes definitions, and requirements for 3D printed building design, construction and special inspections, which rely on the design being evaluated in advance by an approved agency for compliance with UL 3401. The resulting compliance report includes the information needed by the contractor and code official to verify compliance with applicable code requirements, and to verify that the 3D printing process and materials used on site are the same as those used during the UL 3401 evaluation and testing. The special inspection requirements are necessary because the portions of the fabrication process such as 3D printer settings, deposition rates and thickness, and curing processes, require special expertise to evaluate, especially when they include proprietary formulations, equipment and settings.

A companion proposal introduces revisions to R301.1.1 that also references UL 3401 and 3D printed building construction. These two proposals will work together, but each also stands on its own.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal will not increase the cost of construction because it covers a construction technique that is not currently addressed in the code.

Staff Analysis: A review of the standard proposed for inclusion in the code, UL 3401-19, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RB302-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: There are no technical requirements in this code section. This seems to be a process or a means and method of construction. There are a number of references to the approval of the building official. The special inspection section needs to be tightened up. The system should have a peer review. This type of construction is akin to manufactured housing and similar issues to those in the manufactured housing appendix should be addressed. These provisions rely heavily on UL 3401 and the compliance report and take approval out of the hands of the code official. (Vote: 9-1)

Assembly Action: **None**

RB302-19

Individual Consideration Agenda

Public Comment 1:

IRC®: Appendix U (New), SECTION U101 (New), U101 (New), SECTION U102 (New), U102.1 (New), SECTION U103 (New), U103.1 (New), U103.2 (New), U103.3 (New), U103.4 (New), U103.5 (New), SECTION U104 (New), U104.1 (New), U104.2 (New), U104.3 (New), U104.4 (New), SECTION U105 (New), U105.1 (New)

Proponents:
Howard Hopper, representing UL LLC (howard.d.hopper@ul.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

Appendix U
3D PRINTED BUILDING CONSTRUCTION

SECTION U101
General

U101 Scope. Buildings, structures and building elements ~~and structures~~ fabricated in whole or in part using 3D printed construction techniques shall be designed, constructed and inspected in accordance with the provisions contained in this Appendix and other applicable requirements in this code.

SECTION U102
Definitions

U102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

3D PRINTED BUILDING CONSTRUCTION. A process for fabricating buildings , structures and building elements ~~and structures~~ from 3D model data using automated equipment that deposits construction material in a layer upon layer fashion.

FABRICATION PROCESS. Preparation of the job site and construction material, and the deposition, curing, finishing, insertion of components and other methods used to construct ~~build~~ building elements such as walls, partitions, roof assemblies and structural components, and the means used to connect assemblies togeth

<Other definitions unchanged>

SECTION U103
Building Design

U103.1 Design organization. 3D printed buildings, structures and building elements ~~and structures~~ shall be designed by an organization certified in accordance with UL 3401 by an approved agency and approved by the building official in accordance with ~~based on~~ this section.

U103.2 Design approval ~~Engineered design~~. The ~~plans included in the~~ structural design, construction documents, and UL 3401 ~~compliance report~~ report of findings shall be submitted for review and approval in accordance with Section 104.11 of this code. ~~shall be used for determining compliance with the engineered design requirements in Section R301.1.3 of the International Residential Code.~~

~~**U103.3 Performance design.** The requirements in Chapters 4 through 9 and Chapter 11 of this code shall be waived where the UL 3401 compliance report demonstrates that the 3D printed construction provides an equivalent level of performance as the prescriptive code requirements.~~

~~**U103.4 Other Equipment and Systems.** Where not covered by the UL 3401 compliance report, the following provisions of this code shall be used as a basis for determining compliance for the following equipment and systems:~~

1. ~~Chimneys and fireplaces – Part III, Chapter 10.~~
2. ~~Energy efficiency – Part IV.~~
3. ~~Mechanical – Part V.~~
4. ~~Fuel gas – Part VI.~~
5. ~~Plumbing – Part VII.~~
6. ~~Electrical – Part VIII.~~

~~**U103.5 Ratings** The building or structure ratings in the UL 3401 compliance report, including but not limited to fire-resistance, interior finish, roofing fire classification, insulation material R-value shall be suitable for the installation. The acceptability of material and system ratings not included in the compliance report shall be determined by the building official.~~

SECTION U104
BUILDING CONSTRUCTION

U104.1 Construction. 3D printed buildings, structures, and building elements ~~and structures~~ shall be constructed in accordance with this section.

U104.2 Construction method. The building construction method, consisting of the manufacturer's *production equipment* and *fabrication process* shall be in accordance with the UL 3401 ~~compliance report~~ report of findings. The unique identifier of the construction method used shall match the identifier in the UL 3401 ~~compliance report~~ report of findings.

U104.3 Additive manufacturing materials. Only the listed *additive manufacturing materials* identified in the UL 3401 ~~compliance report~~ report of findings shall be used to fabricate the building structure or system components. Containers of the additive manufacturing materials shall be labeled.

U104.4 Depositing of manufacturing materials. Manufacturing materials shall only be deposited where ambient temperature and environmental conditions at the job site are within limits specified in the UL 3401 ~~compliance report~~ report of findings. The maximum number of layers permitted, specified curing time and any surface preparation or finishing shall be performed as specified in the UL 3401 ~~compliance report~~ report of findings.

SECTION U105
Special Inspections

U105.1 Initial inspection An initial inspection of the *production equipment*, including 3D printer, and the *fabrication process* shall be performed after the *production equipment* is located onsite and before building fabrication has begun. The inspection shall be conducted by representatives of the approved agency ~~organization~~ that evaluated the *fabrication process* for compliance with UL 3401. The inspection shall verify that the *fabrication~~s~~ process*, including *production equipment*, 3D printing parameters and ~~construction~~ additive manufacturing materials are in accordance with the UL 3401 ~~compliance report~~ report of findings, and the proprietary information in the UL 3401 detailed report of findings.

> **Exception:** Where approved by the building official, inspections of the *production equipment*, including 3D printer, and the *fabrication process* used in a single housing tract shall be conducted on the first building to be constructed, and on a selected number of subsequent buildings, where the same equipment, equipment operators and *fabrication process* are used on all buildings. The number of inspections to be performed shall be determined by the building official.

Commenter's Reason: The original proposal has been revised to address concerns raises prior to and at the committee action hearings. Items to consider:

1. At the CAH hearings six people testified in support and no one testified against the proposal.
2. The IRC currently requires 3D printed buildings and building elements to be evaluated using alternate materials and methods requirements, with no additional guidance to follow. This appendix provides additional technical information that designers and local building officials can use to justify equivalency.
3. There was concern that the UL 3401 report of findings superseded the building official approval process. This is not the case, the UL 3401 report provides technical information on the 3D printing process, fabrication methods and materials used, ratings achieved for code mandated tests, and other construction details. Together with the structural design and construction documents this provides a solid technical foundation for the building official to use to evaluate the 3D printed building construction under the alternate materials and methods requirements in Section 104.11.
4. The public comment clarifies the documents to be provided to the building official to approve the 3D printed construction, which include the structural design, construction documents, and UL 3401 report of findings. It also deleted unnecessary prescriptive requirements originally in

Sections U103.3 through U103.5.

5. A question was raised about the qualifications of the special inspector. Testimony from the floor indicated there are no specific qualification for special inspectors in the I-codes, and IBC Section 1704.1 requires special inspections to be performed by an approved agency. This proposal requires the UL 3401 evaluation to performed by an approved agency (U101.1), and the special inspector to be a representative of this approved agency (U105.1)
6. There was a comparison of the 3D printed construction to factory built housing. To clarify, this Appendix covers homes constructed (3D printed) at the installation site.
7. A comment was made about the building official not being able to require a peer review of the project design documents. This is not the case, the jurisdiction can still require a peer review under existing code provisions.
8. Bottom line, this comment provides a methodology and technical information that building officials can use to approve 3D printed buildings, structures and building elements under the IRC equivalency requirements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal covers a construction technique that is not currently addressed in the code.

Public Comment# 1602