Resiliency Subworkgroup
Pretlow Anchor Branch Norfolk Public Library
111 W. Oceanview Ave, Norfolk, VA
March 10, 2020

Phil Abraham	Vector Corp
Chelsea Harnish	VA EE Council
Whitney Katchmark	Hampton Roads Planning District
Ben McFarlane	Hampton Roads Planning District
George Homewood	City of Norfolk
Steven Shapiro	City of Hampton Building Official
Rebecca Quinn	FEMA Building Science
Stacey Smith	Viridiant
Glen Overcash	AECOM/FEMA
Charlie Baker	FEMA Region 3
Garrett Dyer	VDFP/SFMO
Steve Sunderman	Terrazia PC, LEED Architect
Kenney Payne	AIA Virginia
Cindy Davis	DHCD
Thomas King	DHCD
Jeff Brown	DHCD
Richard Potts	DHCD
Lee Hutchinson	DHCD
Travis Luter	DHCD

Summary

Mr. Brown opened the meeting with introductions. The first item for discussion comes from 2021 approved proposals related to resiliency. Mrs. Quinn summarized the FEMA proposals related to resiliency starting with 1612.4.

B1612.4-18 – Consensus Approved
Mrs. Quinn said it is FEMA's position that they want uniformity on the type of documentation being required and so this proposal captures that. Mr. Shapiro pointed out that all the 2021 items up for discussion were reviewed by engineers and professionals at the national level as well as the OGCV process and are, therefore, well vetted proposals. Mr. Homewood noted that breakaway walls are part of FEMAs "higher standards" provisions and some localities in Coastal A and VE zones have banned breakaway walls already.

Mr. Brown pointed out the process for proposals approved here, that they will go to the full Workgroup Committee and Mr. Potts pointed out the deadlines for submission of items to be considered.

RB322.2.1-18 – Consensus Approved

Mrs. Quinn points out this is paired with **R322.3.2** and we are only showing 2 of the changes and there are a few others, including 309.5 which currently has provisions for Garages. She summarized that this is not a technical change, but makes clearer the distinction and she recommends adding R309.5 to these two (R322.2.1 and R322.3.2) and further that the change in R309.5 is primarily a pointer. Additionally that for these proposals FEMA secured the support of the National Homebuilders Association.

Mr. Homewood asked if there was a word missing from one of the proposals. Mrs. Quinn researched her documents and confirmed that sub-section 4.2 should begin with the word "They" and not "The". Mr. Payne asked about the relevance of carports for this provision which Mrs. Quinn answered. Mr. Brown asked if this was related to NFIP. Mrs. Quinn said the purpose is that is to indicate that it should not be permitted to enclose carports unless they meet these provisions.

RB322.3.3 – Consensus Approved

Mr. Shapiro asked why we are striking "slabs and pools" and the group researched and discovered that this was moved from 2015 to 2018 and so when comparing the 2021 to our current code this section should be removed. Mr. Brown asked if the group was in consensus.

B1612.2.1 – Consensus Approved (BFE+2)

Mr. Brown summarized that this set of proposals are not in code change format and are, instead, a guide that can be used to determine what's the best flood elevation height for a particular flood hazard area. Mr. Homewood proposed the BFE plus 3 is desirable but that he would be OK with BFE plus 2. The rest of the room was in agreement that plus 2 was better but with the reservation that the Homebuilders of Virginia may not be in agreement. Mr. Homewood answered a question about the cost of one foot of elevation versus two feet. In Norfolk, they studied it and it's under $10,000. Mr. Payne pointed out that there is a concern for ADA compliance as only single family homes are exempt and other elevated buildings would require a ramp, and with three feet of elevation it would be a large ramp. Mr. Brown summarized that as the group was in agreement, that staff would pull out all the Base Flood Elevation sections in flood hazard sections, coastal high hazard areas and A zones, as well as ASCE 24, and create a proposal.

B1804.8 – Approved As Amended

Mr. Shapiro said that 1804.8 should be changed to "AHJ" or "as approved" instead of engineer. Mr. Homewood questioned how this would work in cities that aren't as flat a Norfolk. Mr. Homewood argued for banning slab on grade adjacent to roads and suggested we should promote raised slab construction in these regions. Mr. Payne asked if this would supersede the change to BFE+2 from above. Mrs. Quinn explained how it would work like the rest of the code where the higher standard takes precedent. The group argued that this provision should not be tied to an adjacent road and should instead be structured to the "highest adjacent grade unless otherwise approved." The group agreed to strike the new definition and Mr. Shapiro said that ASCE 24 has a definition for "highest adjacent grade" that we can reference or pull into our code.

1612.2 and Enclosed Areas Below Elevation – Tabled

The group briefly discussed these sections (1612.2, R322.2.2, R322.3.5, R322.3.6, R322.3.3). Mr. Shapiro said that he cannot support these changes as it would overrule the structural engineers that approved these sections in the international process. The group briefly discussed moving R322.3.3 forward with the deleted exception, but that did not have support.

Mr. Brown asked if anyone would take this proposal on as it does not have committee support, and Mr. Homewood said it should be tabled.

RB35 – Consensus Approved

Mr. Overcash presented the justifications for this section. It was approved by the international review process and is not a FEMA proposal. It was put forward by ASCE, IBHS, and CSC and would bring Virginia into ASCE 7-16. Mr. Payne had questions about the special wind regions and where they apply on the map. There was no opposition to the proposal. Mr. Overcash stated that he would submit his proposal in cdpVA and Staff would put it forward as a subworkgroup recommendation.

B1709.5.2-18 – Consensus Approved

The sentence "Structural performance of garage doors…shall meet the acceptance criteria of ANSI/DASMA 108" was agreed to be deleted.

RB609.4-18 – Approved As Amended

Mr. Homewood asked if we could mandate that the labels were affixed to the door. Mr. Brown explained how the definition of "label" and "labeled" already mandate that. The group agreed to italicize "label" and "labeled" and change "provided" to "affixed".

R703.11.1 Soffits (VRC) – Consensus Approved

Mr. Overcash summarized that this is a joint FEMA/IBHS proposal that incorporates design standards in the Florida Building Codes. These changes resulted from some of the studies conducted after Hurricane Irma and Harvey that found that cheap materials used in soffits were causing the roof to uplift in high wind scenarios and destroy the home. Mr. Brown summarized that this proposal is already approved in the 2021 process.

RB301.2.1.-18– Consensus Approved

Mr. Overcash summarized that this is an approved proposal from the 2021 cycle with changes that clarify the use of ultimate design wind speed for special wind regions.

RB332 – Consensus Approved

Mr. Shapiro recommended we change language in Item 1 to "Shall be permitted" instead of "can be". Mrs. Harnish asked if this was 2021 language and remarked on the irony of mandating connections for fossil fuel burning equipment – home generators – when the purpose of the resiliency SWG is to address the result of climate change, which is caused by fossil fuel pollution. Mr. Shapiro recommended instead of making edits to this, that we just approve it and let the full Workgroup tweak the language.

RB200 – Approved as Amended

Mr. Brown summarized that this was from Kristen Owens office and would add the identical definition for "substantial damage" that exists in the VEBC and VCC and duplicate it in the IRC/VRC. Mrs. Quinn asked about the “substantial improvement” definition from the VEBC. The group agreed to duplicate both improvement and damage definition in the IRC.

ASCE 24 Reference to FEMA Technical Bulletins – Consensus Disapproval

Mr. Shapiro is completely opposed to altering the text of a reference standard with our code language.

George Homewood Proposals

Administration

A102.2.2-18 - Tabled

Mrs. Quinn asked if the resilience areas would include a map and who would publish it. Mr. Homewood stated that eventually there will be a map. Mr. Shapiro asked why we would create code provisions which would be unenforceable until a map exists, especially when there is no timeframe for this map to be completed. Mrs. Davis asked if these zones would be clear to localities and was hesitant to create many different codes and summarized the need for a Uniform code. Mr. Payne asked if the map would be available by the effective date of the 2018 codes. Mrs. Davis said that we should just skip this section and possibly bring it forward as an emergency proposal once the maps become available.

A109.3-18 – Approved as Amended

Mr. Payne recommended deleting “adequately” and Mrs. Quinn recommends adding “Section 1612 for dry floodproofing and Chapter 16 of tis code” as a pointer for dryfloodproofing.

A113.1-18 – Approved as Amended

Mrs. Quinn suggested we add “located… in any flood hazard area or special flood hazard area” to Item 4. Mr. Brown said staff would correlate the elevation inspection provisions to where they exist in the Virginia administration sections so that they are conducted before construction can proceed beyond base elevation.

A117.2-18 – Consensus as Amended

Mr. Payne pointed out his e-mail where he edited this with “if required by Chapter 15 and R322 of the IRC…”. The group agreed to those changes.

Definitions - Tabled

Mr. Payne recommended we change the word “community” to “locality” throughout the definitions proposal. Mrs. Quinn said that we should not change “Design Flood Elevation” to include additional height above the water as it could cause confusion between *base flood* and *design flood*. Mr. Homewood offered to break up his definitions into individual proposals with reason statements.

Certification - Tabled

Section 1612.4 item 2.3 conflicts with other business conducted in this meeting so we should delete that section. Mr. Payne has concerns with 1603.1.7 about using “grade beam” for a reference.

Closing

Mr. Brown apologized for going over and not having time to discuss the Florida Building Codes in this meeting. He asked the attendees to go back and review the items we discussed today and see if there was a consensus item we could bring back in, and if we can, we will look into scheduling an additional meeting.

B1612.4-18

IBC®: 1612.4

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Building Code

1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a *registered design professional* and submitted to the *building official*:

1. For construction in *flood hazard areas* other than *coastal high hazard areas* or *coastal A zones*:
   - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.
   - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, *construction documents* shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
   - 1.3. For dry floodproofed nonresidential buildings, *construction documents* shall include a statement that the dry floodproofing is designed in accordance with ASCE 24, and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.
2. For construction in *coastal high hazard areas* and *coastal A zones*:
   - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.11.1.
   - 2.2. *Construction documents* shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
   - 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m^2) determined using *allowable stress design*, *construction documents* shall include a statement that the breakaway wall is designed in accordance with ASCE 24.
   - 2.4. For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

Reason Statement: Consensus Approval item from Resiliency Subworkgroup

Bibliography: This proposal will increase Resiliency
Additional compliance with ASCE 24 will increase resiliency.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is primarily an administrative change and will require documentation.

RB322.2.1-18

IRC®: R322.2.1, R322.3.2, R309.3

Proponents: Thomas King (thomas.king@dhcd.virginia.gov); Rebecca Quinn (rcquinn@earthlink.net)

2018 International Residential 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 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 design flood elevation, 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.
4. The use of fill for structural support is prohibited.
5. 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. Walls and partitions enclosing areas below the ~~design flood~~ elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

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.

Reason Statement: Consensus Approval item from the Resiliency Subworkgroup

Bibliography: This proposal will increase Resiliency
This proposal will increase resiliency by ensuring garages and carports are not enclosed in Flood Hazard Areas.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is not a technical requirement, it just forbids a practice already limited in flood prone localities.

RB322.3.3-18

IRC®: R322.3.3

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Residential Code

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns.

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.

2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). ~~Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.~~ Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. ~~Pile systems design and installation shall be certified in accordance with Section R322.3.9. Spread~~

3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24 .

4. Flood and wave loads shall be those associated with the design flood. Wind loads shall be those required by this code.

5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

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

Reason Statement: This is a consensus approval item from the Resiliency Subworkgroup

Bibliography: This proposal will increase Resiliency
These items will affect pile and column design in flood areas.

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

B1612.2.1-18

IBC®: 1612.2, 1612.2.1 (New); IRC®: R322.2.1, R322.3.2

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Building Code

1612.2 Design and construction. The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

Revise as follows:

1612.2.1 Modification of ASCE 24: Elevation requirements. The minimum elevation requirements shall be as specified in ASCE 24 or the base flood elevation plus 2 feet, whichever is higher.

2018 International Residential 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)~~ 2 feet (610 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)~~ 2 feet (610 mm), or the design flood elevation, whichever is higher.

Exception: Enclosed areas below the design flood elevation, including *basements* with floors that are not below *grade* on all sides, shall meet the requirements of Section R322.2.2.

Revise as follows:

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)~~ 2 feet (610 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below *grade* on all sides are prohibited.
3. The use of fill for structural support is prohibited.
4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
5. Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.5 and R322.3.6.

Reason Statement: This item was consensus approval by the Resiliency Subworkgroup and adjusts all base flood elevation requirements to BFE +2 feet.

Bibliography: This proposal will increase Resiliency
This will increase resilience to flood damage.

Cost Impact: The code change proposal will increase the cost of construction
The additional height in construction will increase costs.

B1804.8-18

IBC®: (New); IRC®: 200 (New); IBC®: 1804.8 (New); IRC®: R501.3 (New)

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Building Code

Add new text as follows:

HIGHEST ADJACENT GRADE
Highest elevation of the finished ground surface prior to construction next to the proposed foundation of a *structure* .

2018 International Residential Code

Add new text as follows:

HIGHEST ADJACENT GRADE
Highest elevation of the finished ground surface prior to construction next to the proposed foundation of a *structure*.

2018 International Building Code

Add new text as follows:

1804.8 Protection from local drainage. The top surface of floor systems and concrete floors shall be elevated to one foot (305 mm) above the highest adjacent grade unless otherwise approved.

2018 International Residential Code

Add new text as follows:

R501.3 Protection from local drainage. The top surface of floor systems and concrete floors shall be elevated to one foot (305 mm) above the highest adjacent grade unless otherwise approved.

Reason Statement: This proposal is a consensus item from the resiliency subworkgroup and incorporates ASCE 24-14 definition for Highest Adjacent Grade but modified to specify the finished grade.

Bibliography: This proposal will increase Resiliency
This proposal increases resiliency by reducing flood risk adjacent to buildings.

Cost Impact: The code change proposal will increase the cost of construction
This change proposal will increase the cost by requiring additional elevation in some flood areas.

RB35-19

IRC®: TABLE R301.2(2), TABLE R301.2(2) (New), TABLE R301.2(3), FIGURE R301.2(8), FIGURE R301.2(5)A, FIGURE R301.2(5)B

Proponent: Jennifer Goupil, American Society of Civil Engineers (ASCE), representing American Society of Civil Engineers (ASCE) (jgoupil@asce.org); Don Scott, representing Representing National Council of Structural Engieers Association (dscott@pcs-structural.com); T. Eric Stafford, Insurance Institute for Business and Home Safety, representing Insurance Institute for Business and Home Safety (testafford@charter.net)

2018 International Residential Code

Delete without substitution:

~~TABLE R301.2(2)~~
~~COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf)~~[a, b, c, d, e]

Delete table in its entirety.

Add new text as follows:

TABLE R301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf) [a,b,c,d,e,f,g]

	Zone	Effective Wind Areas (feet²)	Ultimate Design Wind Speed, V_{ult}																									
			90		95		100		105		110		115		120		130		140		150		160		170		180	
			Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
Flat and Gable Roof 0 to 7 degrees	1	10	3.6	-13.9	4.0	-15.5	4.4	-17.2	4.8	-19.0	5.3	-20.8	5.8	-22.7	6.3	-24.8	7.4	-29.1	8.6	-33.7	9.9	-38.7	11.2	-44.0	12.7	-49.7	14.2	-55.7
	1	20	3.3	-13.0	3.7	-14.5	4.1	-16.0	4.5	-17.7	5.0	-19.4	5.4	-21.2	5.9	-23.1	7.0	-27.1	8.1	-31.4	9.3	-36.1	10.5	-41.1	11.9	-46.4	13.3	-52.0
	1	50	3.0	-11.8	3.4	-13.1	3.8	-14.5	4.1	-16.0	4.5	-17.6	5.0	-19.2	5.4	-20.9	6.3	24.5	7.4	-28.4	8.4	-32.6	9.6	-37.1	10.8	-41.9	12.2	-47.0
	1	100	2.8	-10.8	3.1	-12.1	3.5	-13.4	3.8	-14.7	4.2	-16.2	4.6	-17.7	5.0	-19.2	5.9	-22.6	6.8	-26.2	7.8	-30.0	8.9	-34.2	10.0	-38.6	11.3	-43.3
	2	10	3.6	-18.4	4.0	-20.5	4.4	-22.7	4.8	-25.0	5.3	-27.4	5.8	-30.0	6.3	-32.7	7.4	-38.3	8.6	-44.5	9.9	-51.0	11.2	-28.1	12.7	-65.6	14.2	-73.5
	2	20	3.3	-17.2	3.7	-19.2	4.1	-21.2	4.5	-23.4	5.0	-25.7	5.4	-28.1	5.9	-30.6	7.0	-35.9	8.1	-41.6	9.3	-47.8	10.5	-54.3	11.9	-61.4	13.3	-68.8
	2	50	3.0	-15.6	3.4	-17.4	3.8	-19.3	4.1	-21.3	4.5	-23.3	5.0	-25.5	5.4	-27.8	6.3	-32.6	7.4	-37.8	8.4	-43.4	9.6	-49.4	10.8	-55.8	12.2	-62.5
	2	100	2.8	-14.4	3.1	-16.1	3.5	-17.8	3.8	-19.7	4.2	-21.6	4.6	-23.6	5.0	-25.7	5.9	-30.1	6.8	-35.0	7.8	-40.1	8.9	-45.7	10.0	-51.5	11.3	-57.8
	3	10	3.6	-25.0	4.0	-27.9	4.4	-30.9	4.8	-34.1	5.3	-37.4	5.8	-40.9	6.3	-44.5	7.4	-52.2	8.6	-60.6	9.9	-69.6	11.2	-79.1	12.7	-89.4	14.2	-100.2
	3	20	3.3	-22.6	3.7	-25.2	4.1	-28.0	4.5	-30.8	5.0	-33.8	5.4	-37.0	5.9	-40.3	7.0	-47.2	8.1	-54.8	9.3	-62.9	10.5	-71.6	11.9	-80.8	13.3	-90.6
	3	50	3.0	-19.4	3.4	-21.7	3.8	-24.0	4.1	-26.5	4.5	-29.0	5.0	-31.7	5.4	-34.6	6.3	-40.6	7.4	-47.0	8.4	-54.0	9.6	-61.4	10.8	-69.4	12.2	-77.8
	3	100	2.8	-174.0	3.1	-19.0	3.5	-21.0	3.8	-23.2	4.2	-25.5	4.6	-27.8	5.0	-30.3	5.9	-35.6	6.8	-41.2	7.8	-47.3	8.9	-53.9	10.0	-60.8	11.3	-68.2

Gable Roof >7 to 20 degrees	1, 2e	10	5.4	-16.2	6.0	-18.0	6.7	-19.9	7.4	-22.0	8.1	-24.1	8.8	-26.4	9.6	-28.7	11.3	-33.7	13.1	39.1	15.0	44.9	17.1	-51.0	19.3	-57.6	21.6	-64.6
	1, 2e	20	4.9	-16.2	5.4	-18.0	6.0	-19.9	6.6	-22.0	7.2	-24.1	7.9	-26.4	8.6	-28.7	10.1	-33.7	11.7	-39.1	13.5	-44.9	15.3	-51.0	17.3	-57.6	19.4	-64.6
	1, 2e	50	4.1	-9.9	4.6	-11.0	5.1	-12.2	5.6	-13.4	6.1	-14.7	6.7	-16.1	7.3	-17.5	8.6	-20.6	10.0	-23.8	11.4	-27.4	13.0	-31.1	14.7	-35.2	16.4	-39.4
	1, 2e	100	3.6	-5.0	4.0	-5.6	4.4	-6.2	4.8	-6.9	5.3	-7.5	5.8	-8.2	6.3	-9.0	7.4	-10.5	8.6	-12.2	9.9	-14.0	11.2	-15.9	12.7	-18.0	14.2	-20.2
	2n, 2r, 3e	10	5.4	-23.6	6.0	-26.3	6.7	-29.1	7.4	-32.1	8.1	-35.2	8.8	-38.5	9.6	-41.9	11.3	-49.2	13.1	-57.0	15.0	-65.4	17.1	-74.5	19.3	-84.1	21.6	-94.2
	2n, 2r, 3e	20	4.9	-20.3	5.4	-22.7	6.0	-25.1	6.6	-27.7	7.2	-30.4	7.9	-33.2	8.6	-36.2	10.1	-42.4	11.7	-49.2	13.5	-56.5	15.3	-64.3	17.3	-72.6	19.4	-81.4
	2n, 2r, 3e	50	4.1	-16.0	4.6	-17.9	5.1	-19.8	5.6	-21.8	6.1	-24.0	6.7	-26.2	7.3	-28.5	8.6	-33.5	10.0	-38.8	11.4	-44.6	13.0	-50.7	14.7	-57.2	16.4	-64.2
	2n, 2r, 3e	100	3.6	-12.8	4.0	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	5.8	-20.9	6.3	-22.8	7.4	-26.7	8.6	-31.0	9.9	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3
	3r	10	5.4	-28.0	6.0	-30.2	6.7	-34.6	7.4	-38.1	8.1	-41.8	8.8	-45.7	9.6	-49.8	11.3	-58.4	13.1	-67.8	15.0	-77.8	17.1	-88.5	19.3	-99.9	21.6	-112.0
	3r	20	4.9	-24.0	5.4	-26.7	6.0	-29.6	6.6	-32.7	7.2	-35.9	7.9	-39.2	8.6	-42.7	10.1	-50.1	11.7	-58.1	13.5	-66.7	15.3	-75.9	17.3	-85.6	19.4	-96.0
	3r	50	4.1	18.7	4.6	-20.8	5.1	-23.1	5.6	-25.4	6.1	-27.9	6.7	-30.5	7.3	33.2	8.6	-39.0	10.0	-45.2	11.4	-51.9	13.0	-59.0	14.7	-66.6	16.4	-74.7
	3r	100	3.6	-14.7	4.0	-16.3	4.4	-18.1	4.8	-20.0	5.3	-21.9	5.8	-24.0	6.3	-26.1	7.4	-30.6	8.6	-35.5	9.9	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7
Gable Roof >20 to 27 degrees	1, 2e	10	6.5	-12.4	7.3	-13.9	8.0	-15.4	8.9	-16.9	9.7	-18.6	10.6	-20.3	11.6	-22.1	13.6	-26.0	15.8	-30.1	18.1	-34.6	20.6	-39.3	23.3	-44.4	26.1	-49.9
	1, 2e	20	5.6	-12.4	6.3	-13.9	7.0	-15.4	7.7	-16.9	8.4	-18.6	9.2	-20.3	10.0	-22.1	11.7	-26.0	13.6	-30.1	15.6	-34.6	17.8	-39.3	20.1	-44.4	22.5	-49.8
	1, 2e	50	4.4	-10.6	5.0	-11.8	5.5	-03.1	6.1	-14.4	6.6	-15.8	7.3	-17.3	7.9	-18.8	9.3	-22.1	10.8	-25.6	12.3	-29.4	14.0	-33.5	15.9	-37.8	17.8	-42.4
	1, 2e	100	3.6	-9.1	4.0	-10.2	4.4	-11.3	4.8	-12.4	5.3	-13.6	5.8	-14.9	6.3	-16.2	7.4	-19.0	8.6	-22.1	9.9	-25.3	11.2	-28.8	12.7	-32.5	14.2	-36.5
	2n, 2r, 3e	10	6.5	-19.9	7.3	-22.1	8.0	-24.5	8.9	-27.0	9.7	-29.7	10.6	-32.4	11.6	-35.3	13.6	-41.4	15.8	-48.0	18.1	-55.2	20.6	-62.8	23.3	-70.8	26.1	-79.4
	2n, 2r, 3e	20	5.6	-17.4	6.3	-19.4	7.0	-21.5	7.7	-23.7	8.4	-26.0	9.2	-28.4	10.0	-31.0	11.7	-36.3	13.6	-42.1	15.6	-48.4	17.8	-55.0	20.1	-62.1	22.5	-69.6

	2n, 2r, 3e	50	4.4	-14.2	5.0	-15.8	5.5	-17.5	6.1	-19.3	6.6	-21.1	7.3	-23.1	7.9	-25.2	9.3	-29.5	10.8	-34.2	12.3	-39.3	14.0	-44.7	15.9	-50.5	17.8	-56.6
	2n, 2r, 3e	100	3.6	-11.7	4.0	-13.0	4.4	-14.5	4.8	-15.9	5.3	-17.5	5.8	-19.1	6.3	-20.8	7.4	-24.4	8.6	-28.3	9.9	-32.5	11.2	-37.0	12.7	-41.8	14.2	-46.8
	3r	10	6.5	-23.6	7.3	-26.3	8.0	-29.1	8.9	-32.1	9.7	-35.2	10.6	-38.5	11.6	-41.9	13.6	-49.2	15.8	-57.0	18.1	-65.4	20.6	-74.5	23.3	-84.1	26.1	-94.2
	3r	20	5.6	-19.9	6.3	-22.1	7.0	-24.5	7.7	-27.0	8.4	-29.7	9.2	-32.4	10.0	-35.3	11.7	-41.4	13.6	-48.0	15.6	-55.2	17.8	-62.8	20.1	-70.8	22.5	-79.4
	3r	50	4.4	-14.7	5.0	-16.3	5.5	-18.1	6.1	-20.0	6.6	-21.9	7.3	-24.0	7.9	-26.1	9.3	-30.6	10.8	-35.5	12.3	-40.8	14.0	-46.4	15.9	-52.3	17.8	-58.7
	3r	100	3.6	-14.7	4.0	-16.3	4.4	-18.1	4.8	-20.0	5.3	-21.9	5.8	-24.0	6.3	-26.1	7.4	-30.6	8.6	-35.5	9.9	-40.8	11.2	-46.4	12.7	-52.3	14.2	-58.7
	1, 2e, 2r	10	8.0	-14.7	8.9	-16.3	9.9	-18.1	10.9	-20.0	12.0	-21.9	13.1	-24.0	14.2	-26.1	16.7	-30.6	19.4	-35.5	22.2	-40.8	25.3	-16.4	28.5	-52.3	32.0	-58.7
	1, 2e, 2r	20	7.1	-12.4	7.9	-13.9	8.8	-15.4	9.7	-16.9	10.6	-18.6	11.6	-20.3	12.6	-22.1	14.8	-26.0	17.2	-30.1	19.8	-34.6	22.5	-39.3	25.4	-44.4	28.5	-49.8
	1, 2e, 2r	50	5.9	-9.5	6.6	-10.6	7.3	-11.7	8.1	-12.9	8.9	-14.2	9.7	-15.5	10.5	-16.9	12.4	-19.8	14.3	-22.9	16.5	-26.3	18.7	-30.0	21.1	-33.8	23.7	-37.9
	1, 2e, 2r	100	5.0	-7.3	5.6	-8.1	6.2	-9.0	6.9	-9.9	7.5	-10.8	8.2	-11.9	9.0	-12.9	10.5	-15.1	12.2	-17.6	14.0	-20.2	15.9	-22.9	18.0	-25.9	20.2	-29.0
	2n, 3r	10	8.0	-16.2	8.9	-18.0	9.9	-19.9	10.9	-22.0	12.0	-24.1	13.1	-26.4	14.2	-28.7	16.7	-33.7	19.4	-39.1	22.2	-44.9	25.3	-51.0	28.5	-57.6	32.0	-64.6
	2n, 3r	20	7.1	-14.4	7.9	-16.1	8.8	-17.8	9.7	-19.7	10.6	-21.6	11.6	-23.6	12.6	-25.7	14.8	-30.1	17.2	-34.9	19.8	-40.1	22.5	-45.6	25.4	-51.5	28.5	-57.8
Gable Roof >27 to 45 degrees	2n, 3r	50	5.9	-12.2	6.6	-13.5	7.3	-15.0	8.1	-16.5	8.9	-18.2	9.7	-19.9	10.5	-21.6	12.4	-25.4	14.3	-29.4	16.5	-33.8	18.7	-38.4	21.1	-43.4	23.7	-48.6
	2n, 3r	100	5.0	-10.4	5.6	-11.6	6.2	-12.9	6.9	-14.2	7.5	-15.6	8.2	-17.1	9.0	-18.6	10.5	-21.8	12.2	-25.3	14.0	-29.0	15.9	-33.0	18.0	-37.3	20.0	-41.8
	3e	10	8.0	-19.9	8.9	-22.1	9.9	-24.5	10.9	-27.0	12.0	-29.7	13.1	-32.4	14.2	-35.3	16.7	-41.4	19.4	-48.0	22.2	-55.2	25.3	-62.8	28.8	-70.8	32.0	-79.4
	3e	20	7.1	-17.6	7.9	-19.6	8.8	-21.8	9.7	-24.0	10.6	-26.3	11.6	-28.8	12.6	-31.3	14.8	-36.8	17.2	-42.7	19.8	-49.0	22.5	-55.7	25.4	-62.9	28.5	-70.5
	3e	50	5.9	-14.7	6.6	-16.3	7.3	-18.1	8.1	-20.0	8.9	-21.9	9.7	-24.0	10.5	-26.1	12.4	-30.6	14.3	-35.5	16.6	-40.8	18.7	-46.4	21.1	-52.3	23.7	-58.7
	3e	100	5.0	-12.4	5.6	-13.9	6.2	-15.4	6.9	-16.9	7.5	-18.6	8.2	-20.3	9.0	-22.1	10.5	-26.0	12.2	-30.1	14.0	-34.6	15.9	-39.3	18.0	-44.4	20.2	-49.8

Hipped Roof >7 to 20 degrees[g]	1	10	6.5	-14.7	7.3	-16.3	8.0	-18.1	8.9	-20.0	9.7	-21.9	10.6	-24.0	11.6	-26.1	13.6	-30.6	15.8	-35.5	18.1	-40.8	20.6	-46.4	23.3	-52.3	26.1	-58.7
	1	20	5.6	-14.7	6.3	-16.3	7.0	-18.1	7.7	-20.0	8.4	-21.9	9.2	-24.0	10.0	-26.1	11.7	-30.6	13.6	-35.5	15.6	-40.8	17.8	-46.4	20.1	-52.3	22.5	-58.7
	1	50	4.4	-11.3	5.0	-12.6	5.5	-14.0	6.1	-15.4	6.6	-16.9	7.3	-18.5	7.9	-20.2	9.3	-23.7	10.8	-27.4	12.3	-31.5	14.0	-35.8	15.9	-40.4	17.8	-45.3
	1	100	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
	2r	10	6.5	-19.1	7.3	-21.3	8.0	-23.6	8.9	-26.0	9.7	-28.6	10.6	-31.2	11.6	-34.0	13.6	-39.9	15.8	-46.3	18.1	-53.1	20.6	-60.4	23.3	-68.2	26.1	-76.5
	2r	20	5.6	-17.2	6.3	-19.2	7.0	-21.3	7.7	-23.4	8.4	-25.7	9.2	-28.1	10.0	-30.6	11.7	-35.9	13.6	-41.7	15.6	-47.9	17.8	-54.4	20.1	-61.5	22.5	-68.9
	2r	50	4.4	-14.7	5.0	-16.4	5.5	-18.2	6.1	-20.0	6.6	-22.0	7.3	-24.0	7.9	-26.1	9.3	-30.7	10.8	-35.6	12.3	-40.9	14.0	-46.5	15.9	-52.5	17.8	-58.8
	2r	100	3.6	-12.8	4.0	-14.3	4.4	-15.8	4.8	-17.4	5.3	-19.1	5.8	-20.9	6.3	-22.8	7.4	-26.7	8.6	-31.0	9.9	-35.6	11.2	-40.5	12.7	-45.7	14.2	-51.3
	2e, 3	10	6.5	-20.6	7.3	-22.9	8.0	-25.4	8.9	-28.0	9.7	-30.8	10.6	-33.6	11.6	-36.6	13.6	-43.0	15.8	-49.8	18.1	-57.2	20.6	-65.1	23.3	-73.5	26.1	-82.4
	2e, 3	20	5.6	-18.5	6.3	-20.6	7.0	-22.9	7.7	-25.2	8.4	-27.7	9.2	-30.3	10.0	-32.9	11.7	-38.7	13.6	-44.8	15.6	-51.5	17.8	-58.6	20.1	-66.1	22.5	-74.1
	2e, 3	50	4.4	-15.8	5.0	-17.6	5.5	-19.5	6.1	-21.5	6.6	-23.6	7.3	-25.8	7.9	-28.0	9.3	-32.9	10.8	-38.2	12.3	-43.8	14.0	-49.9	15.9	-56.3	17.8	-63.1
	2e, 3	100	3.6	-13.7	4.0	-15.3	4.0	-16.9	4.8	-18.7	5.3	-20.5	5.8	-22.4	6.3	-24.4	7.4	-28.6	8.6	-33.2	9.9	-38.1	11.2	-43.3	12.7	-48.9	14.2	-54.8
Hipped Roof >20 to 27 degrees	1	10	6.5	-11.7	7.3	-13.0	8.0	-14.5	8.9	-15.9	9.7	-17.5	10.6	-19.1	11.6	-20.8	13.6	-24.4	15.8	-28.3	18.1	-32.5	20.6	-37.0	23.3	-41.8	26.1	-46.8
	1	20	5.6	-10.4	6.3	-11.6	7.0	-12.8	7.7	-14.1	8.4	-15.5	9.2	-16.9	10.0	-18.4	11.7	-21.6	13.6	-25.1	15.6	-28.8	17.8	-32.8	20.1	-37.0	22.5	-41.5
	1	50	4.4	-8.6	5.0	-9.6	5.5	-10.6	6.1	-11.7	6.6	-12.8	7.3	-14.0	7.9	-15.3	9.3	-17.9	10.8	-20.8	12.3	-23.9	14.0	-27.2	15.9	-30.7	17.8	-34.4
	1	100	3.6	-7.3	4.0	-8.1	4.4	-9.0	4.8	-9.9	5.3	-10.8	5.8	-1.9	6.3	-12.9	7.4	-15.1	8.6	-17.6	9.9	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0
	2e, 2r, 3	10	6.5	-16.2	7.3	-18.0	8.0	-19.9	8.9	-22.0	9.7	-24.1	10.6	-26.4	11.6	-28.7	13.6	-33.7	15.8	-39.1	18.1	-44.9	20.6	-51.0	23.3	-57.6	26.1	-64.6
	2e, 2r, 3	20	5.6	-14.4	6.3	-16.1	7.0	-17.8	7.7	-19.7	8.4	-21.6	9.2	-23.6	10.0	-25.7	11.7	-30.1	13.6	-34.9	15.6	-40.1	17.8	-45.6	20.1	-51.5	22.5	-57.8

	2e, 2r, 3	50	4.4	-12.2	5.0	-13.5	5.5	-15.0	6.1	-16.5	6.6	-18.2	7.3	-19.9	7.9	-21.6	9.3	-25.4	10.8	-29.4	12.3	-33.8	14.0	-38.4	15.9	-43.4	17.8	-48.6
	2e, 2r, 3	100	3.6	-10.4	4.0	-11.6	4.4	-12.9	4.8	-14.2	5.3	-15.6	5.8	-17.1	6.3	-18.6	7.4	-21.8	8.6	-25.3	9.9	-29.0	11.2	-33.0	12.7	-37.3	14.2	-41.8
Hipped Roof >27 to 45 degrees	1	10	6.2	-12.4	6.9	-13.9	7.7	-15.4	8.5	-16.9	9.3	-18.6	10.2	-20.3	11.1	-22.1	13.0	-26.0	15.1	-30.1	17.3	-34.6	19.7	-39.3	22.2	-44.4	24.9	-49.8
	1	20	5.4	-11.0	6.0	-12.3	6.7	-13.6	7.4	-15.0	8.1	-16.5	8.9	-18.0	9.6	-19.6	11.3	-23.0	13.1	-26.7	15.1	-30.7	17.1	-34.9	19.4	-39.4	21.7	-44.2
	1	50	4.4	-9.2	4.9	-10.2	5.4	-11.3	5.9	-12.5	6.5	-13.7	7.1	-15.0	7.7	-16.3	9.1	-19.2	10.5	-22.2	12.1	25.5	13.8	-29.0	15.5	-32.8	17.4	-36.7
	1	100	3.6	-7.8	4.0	-8.7	4.4	-9.6	4.8	-10.6	5.3	-11.6	5.8	-12.7	6.3	-13.8	7.4	-16.2	8.6	-18.8	9.9	-21.6	11.2	-24.6	12.7	-27.8	14.2	-31.1
	2e	10	6.2	-14.8	6.9	-16.5	7.7	-18.3	8.5	-20.2	9.3	-22.1	10.2	-24.2	11.1	-26.3	13.0	-30.9	15.1	-35.9	17.3	-41.2	19.7	-46.8	22.2	-52.9	24.9	-59.3
	2e	20	5.4	-11.7	6.0	-13.0	6.7	-14.5	7.4	-15.9	8.1	-17.5	8.9	-19.1	9.6	-20.8	11.3	-24.4	13.1	-28.3	15.1	-32.5	17.1	-37.0	19.4	-41.8	21.7	-46.8
	2e	50	4.4	-7.3	4.9	-8.1	5.4	-9.0	5.9	-9.9	6.5	-10.8	7.1	-11.9	7.7	-12.9	9.1	-15.1	10.5	-17.6	12.1	-20.2	13.8	-22.9	15.5	-25.9	17.4	-29.0
	2e	100	3.6	-7.3	4.0	-8.1	4.4	-9.0	4.8	-9.9	5.3	-10.8	5.8	-11.9	6.3	-12.9	7.4	-15.1	8.6	-17.6	9.9	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0
	2r	10	6.2	-18.7	6.9	-20.9	7.7	-23.1	8.5	-25.5	9.3	-28.0	10.2	-30.6	11.1	-33.3	13.0	-39.1	15.1	-45.4	17.3	-52.1	19.7	-59.2	22.2	-66.9	24.9	-75.0
	2r	20	5.4	-15.7	6.0	-17.5	6.7	-19.4	7.4	-21.4	8.1	-23.5	8.9	-25.7	9.6	-28.0	11.3	-32.8	13.1	-38.1	15.1	-43.7	17.1	-49.8	19.4	-56.2	21.7	-63.0
	2r	50	4.4	-11.7	4.9	-13.1	5.4	-14.5	5.9	-16.0	6.5	-17.5	7.1	-19.2	7.7	-20.9	9.1	-24.5	10.5	-28.4	12.1	-32.6	13.8	-37.1	15.5	-41.9	17.4	-47.0
	2r	100	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
	3	10	6.2	-20.0	6.9	-22.3	7.7	-24.7	8.5	-27.2	9.3	-29.9	10.2	-32.7	11.1	-35.6	13.0	-41.7	15.1	-48.4	17.3	-55.6	19.7	-63.2	22.2	-71.4	24.9	-80.0
	3	20	5.4	-15.0	6.0	-16.8	6.7	-18.6	7.4	-20.5	8.1	-22.5	8.9	-24.6	9.6	-26.7	11.3	-31.4	13.1	-36.4	15.1	-41.8	17.1	-47.5	19.4	-53.7	21.7	-60.2
	3	50	4.4	-8.7	4.9	-9.7	5.4	-10.8	5.9	-11.9	6.5	-13.1	7.1	-14.3	7.7	-15.5	9.1	-18.2	10.5	-21.2	12.1	-24.3	13.8	-27.6	15.5	-31.2	17.4	-35.0
	3	100	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0

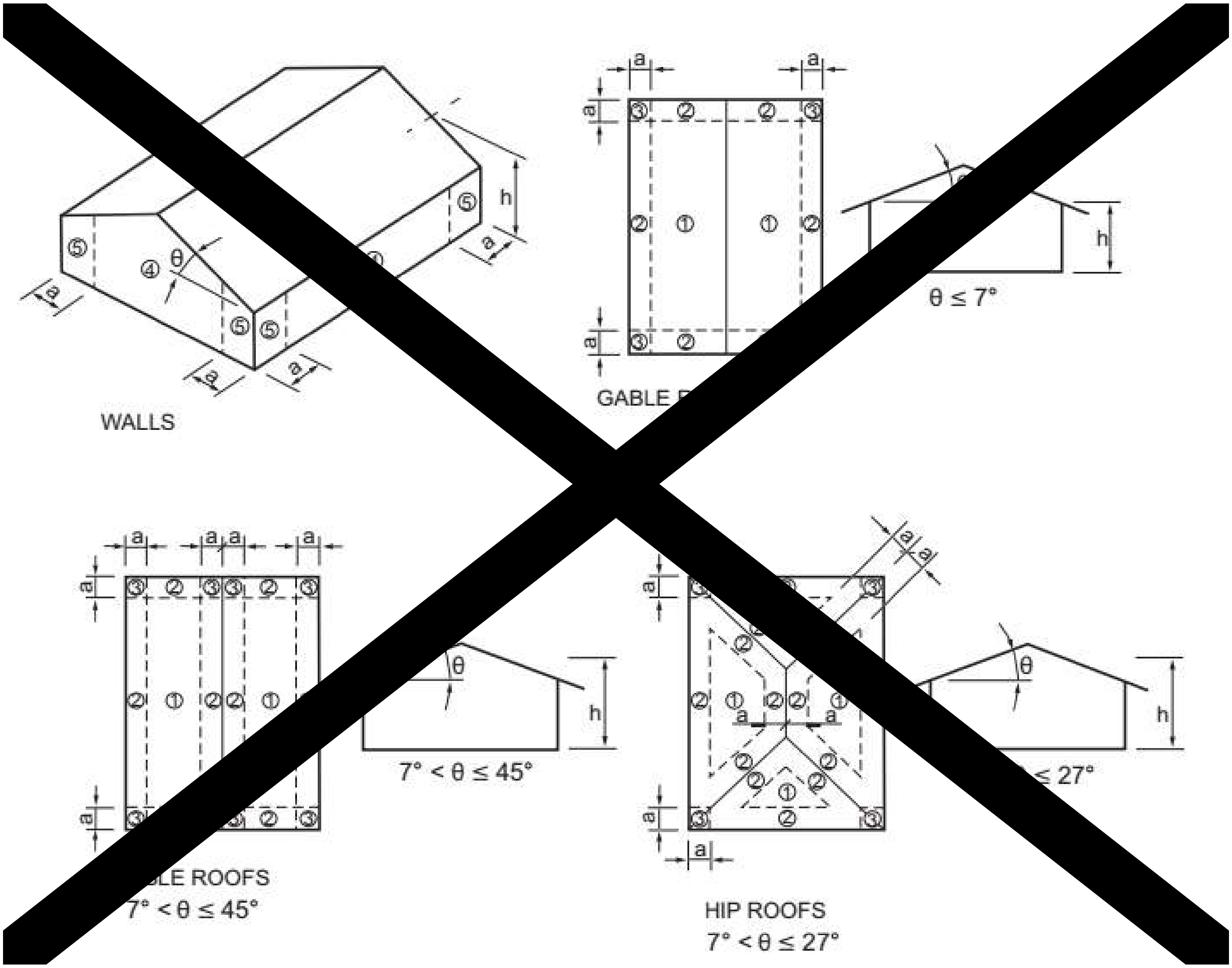
Wall	4	10	8.7	-9.5	9.7	-10.6	10.8	-11.7	11.9	-12.9	13.1	-14.2	14.3	-15.5	15.5	-16.9	18.2	-19.8	21.2	-22.9	24.3	-26.3	27.6	-30.0	31.2	-33.8	35.0	-37.9
	4	20	8.3	-9.1	9.3	-10.1	10.3	-11.2	11.4	-12.4	12.5	-13.6	13.6	-14.8	14.8	-16.2	17.4	-19.0	20.2	-22.0	23.2	-25.3	26.4	-28.7	29.8	-32.4	33.4	-36.4
	4	50	7.8	-8.6	8.7	-9.5	9.7	-10.6	10.7	-11.7	11.7	-12.8	12.8	-14.0	13.9	-15.2	16.3	-17.9	18.9	-20.7	21.7	-23.8	24.7	-27.1	27.9	-30.6	31.3	-34.3
	4	100	7.4	-8.2	8.3	-9.1	9.2	-10.1	10.1	-11.1	11.1	-12.2	12.1	-13.3	13.2	-14.5	15.5	-17.1	18.0	-19.8	20.6	-22.7	23.5	-25.8	26.5	-29.2	29.7	-32.7
	4	500	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.5	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0
	5	10	8.7	-11.7	9.7	-13.0	10.8	-14.5	11.9	-15.9	13.1	-17.5	14.3	-19.1	15.5	-20.8	18.2	-24.4	21.2	-28.3	24.3	-32.5	27.6	-37.0	31.2	-41.8	35.0	-46.8
	5	20	8.3	-10.9	9.3	-12.2	10.3	-13.5	11.4	-14.9	12.5	-16.3	13.6	-17.8	14.8	-19.4	17.4	-22.8	20.2	-26.4	23.2	-30.3	26.4	-34.5	29.8	-39.0	33.4	-43.7
	5	50	7.8	-9.9	8.7	-11.0	9.7	-12.2	10.7	-13.4	11.7	-14.7	12.8	-16.1	13.9	-17.5	16.3	-20.6	18.9	-23.9	21.7	-27.4	24.7	-31.2	27.9	-35.2	31.3	-39.5
	5	100	7.4	-9.1	8.3	-10.1	9.2	-11.2	10.1	-12.4	11.1	-13.6	12.1	-14.8	13.2	-16.1	15.5	-19.0	18.0	-22.0	20.6	-25.2	23.5	-28.7	26.5	-32.4	29.7	-36.3
	5	500	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.6	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0

Revise as follows:

TABLE R301.2(3)
HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE R301.2(2)

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	0.82 ~~1.00~~	1.21	1.47
20	0.89 ~~1.00~~	1.29	1.55
25	0.94 ~~1.00~~	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

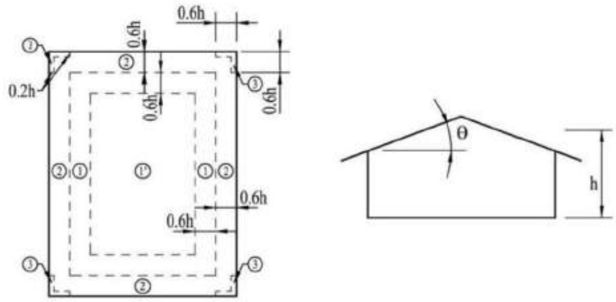
Delete and substitute as follows:



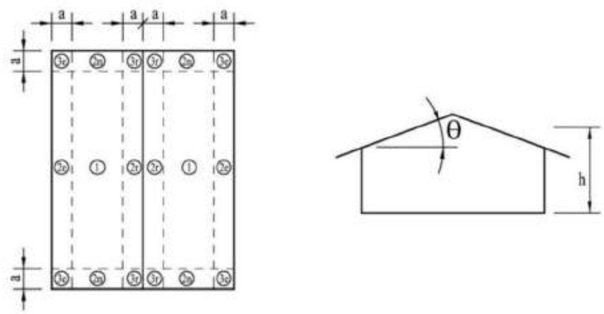
~~For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.~~

~~**Note:** a = 4 feet in all cases.~~

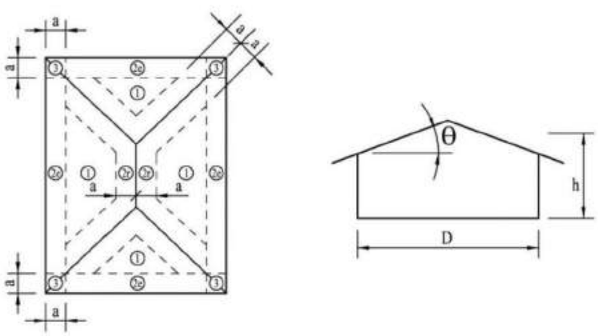
~~FIGURE R301.2(8)~~
~~COMPONENT AND CLADDING PRESSURE ZONES~~



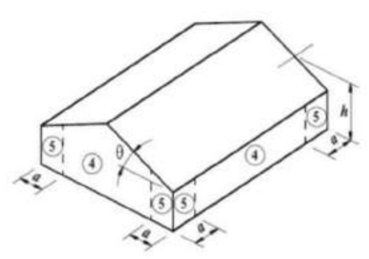
Gable and Flat Roofs θ ≤ 7°



Gable Roofs 7 < θ ≤ 45°



Hip Roofs 7 < θ ≤ 45°

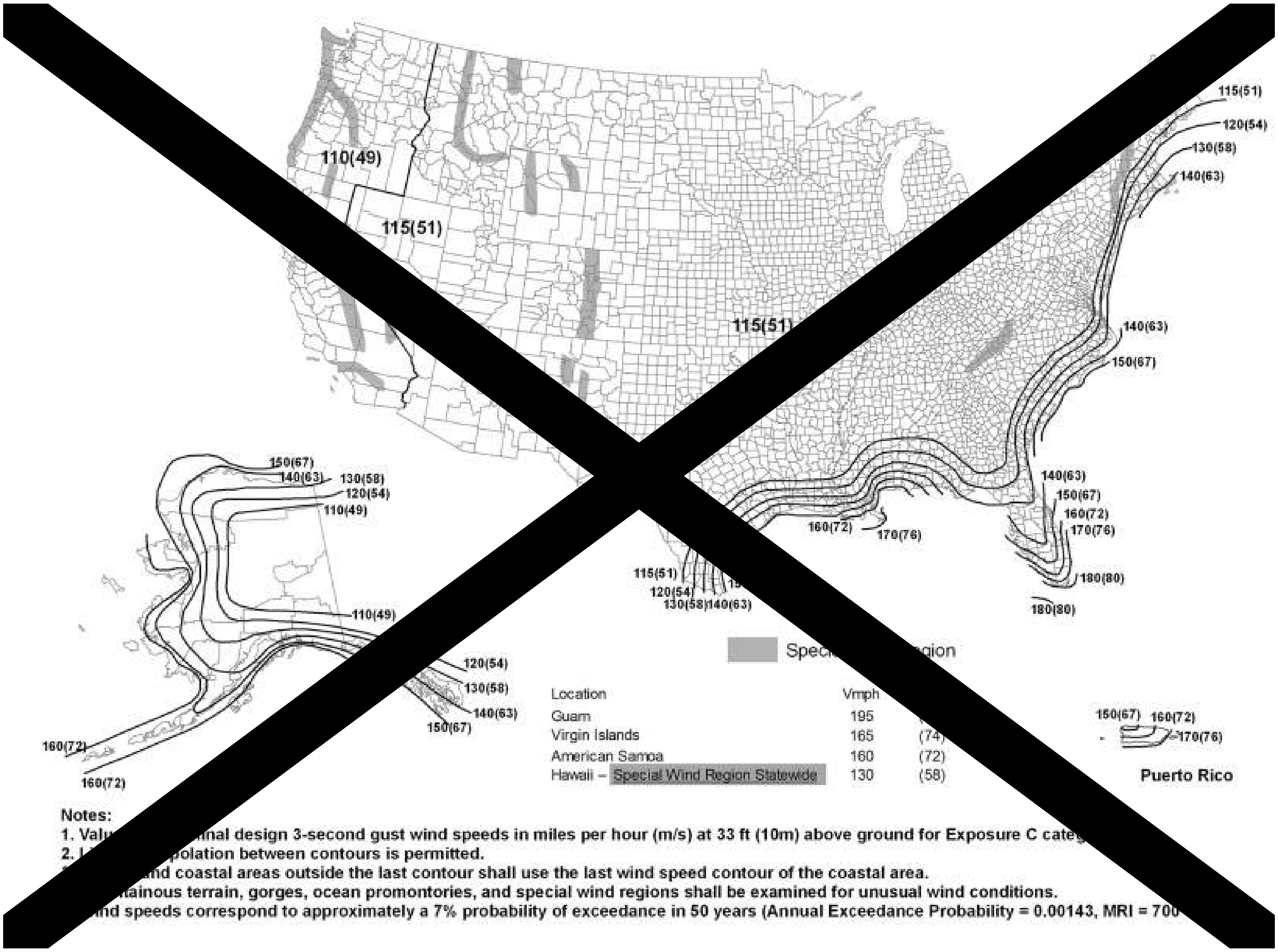


Walls

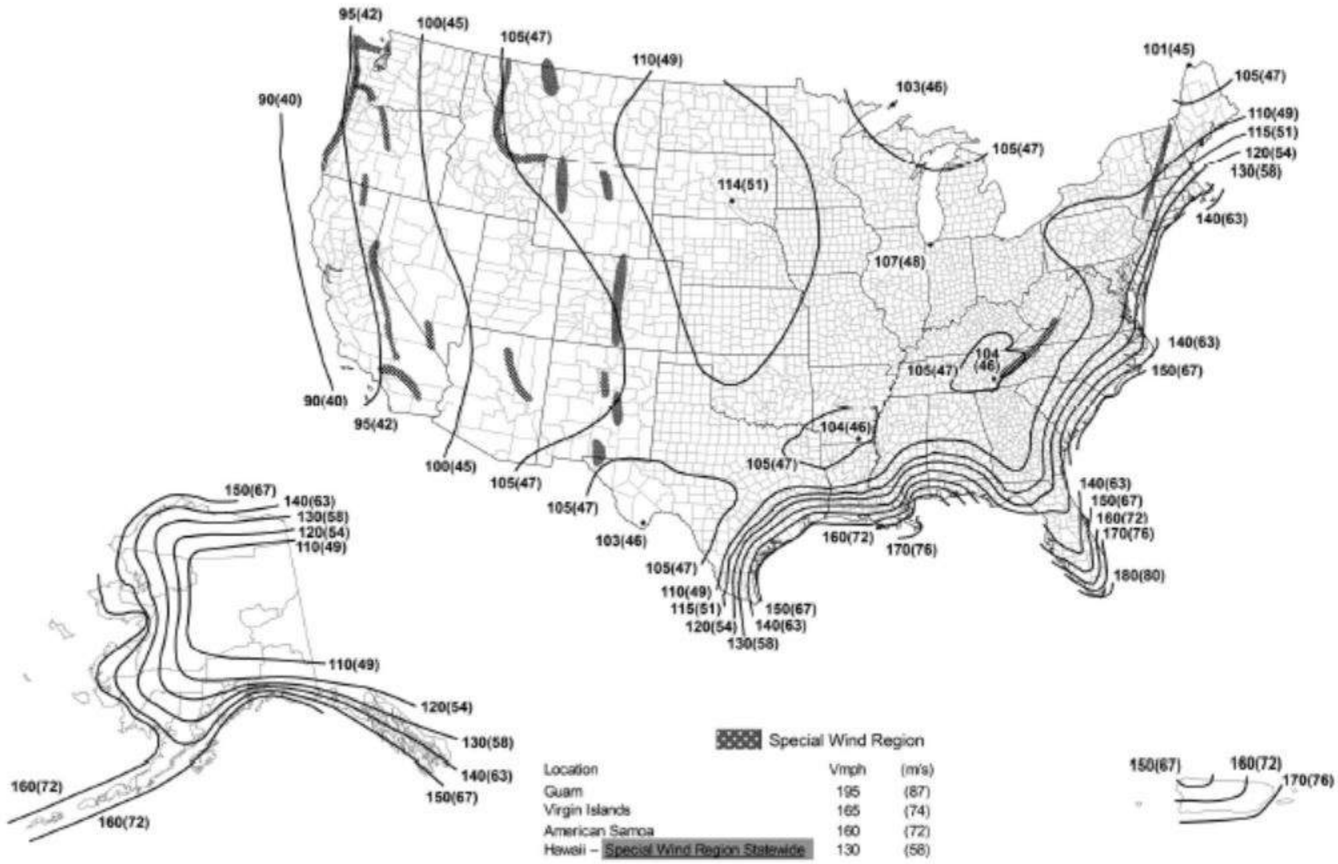
<u>For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.</u>

Note: a = 4 feet in all cases.

FIGURE R301.2(8)
COMPONENT AND CLADDING PRESSURE ZONES



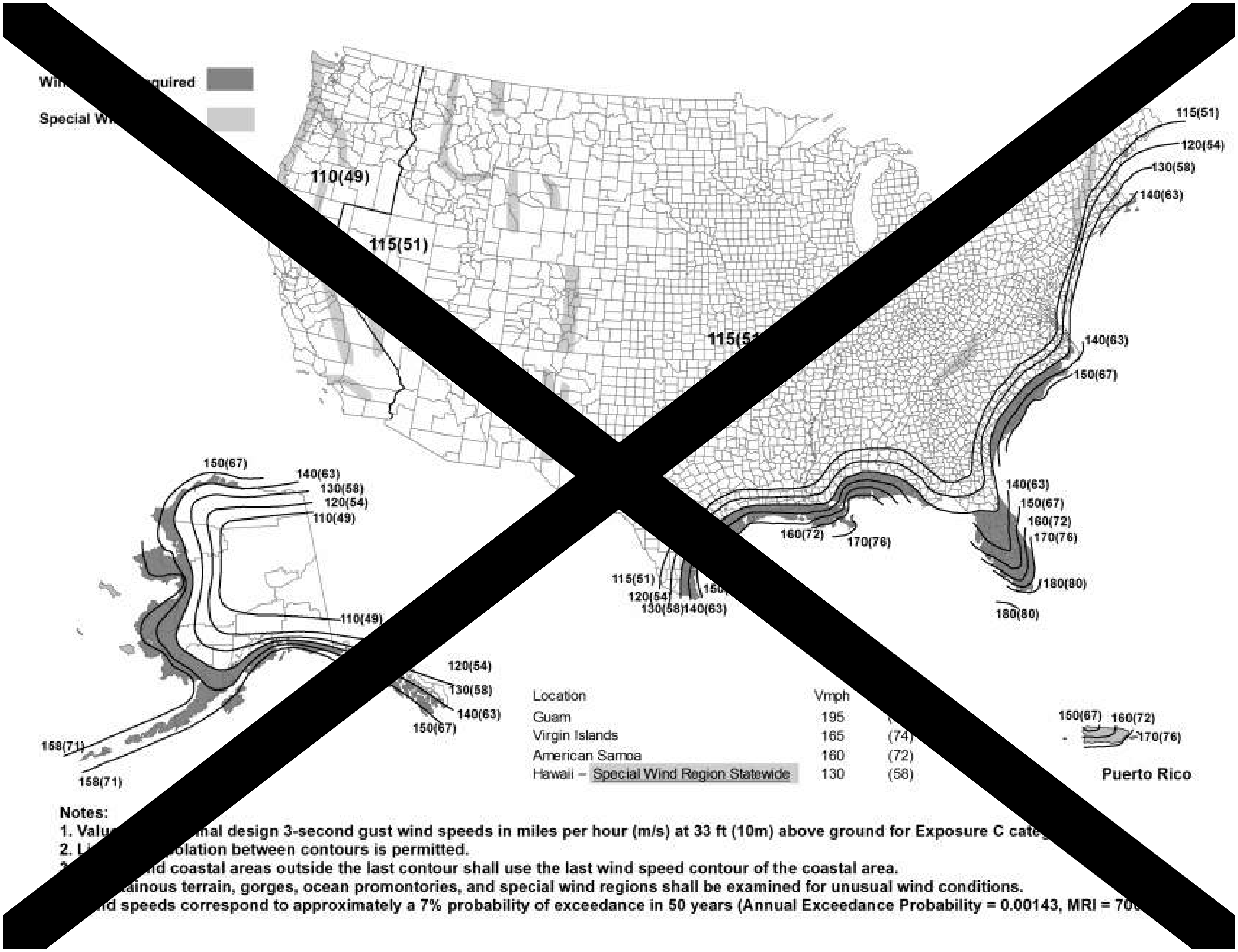
~~FIGURE R301.2(5)A~~
~~ULTIMATE DESIGN WIND SPEEDS~~



Notes:
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

FIGURE R301.2(5)A
ULTIMATE DESIGN WIND SPEEDS

Revise as follows:



110(49)
115(51)
115(51)
120(54)
130(58)
140(63)
150(67)
160(72)
170(76)
180(80)
158(71)
Location
Vmph
Guam 195
Virgin Islands 165 (74)
American Samoa 160 (72)
Hawaii – Special Wind Region Statewide 130 (58)
Puerto Rico
Notes:
nal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C cate
olation between contours is permitted.
nd coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
ainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
nd speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 70

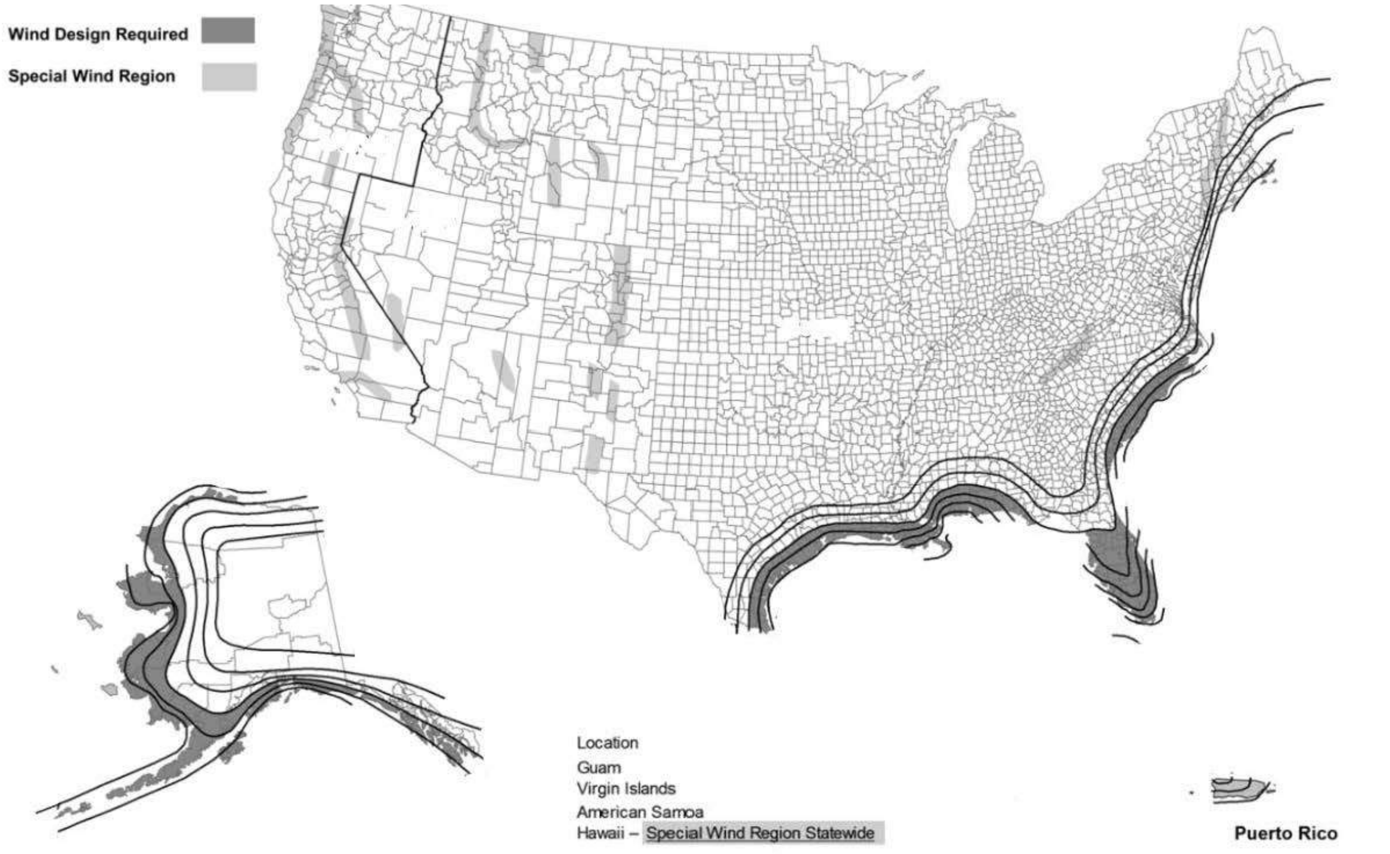


FIGURE R301.2(5)B
REGIONS WHERE WIND DESIGN IS REQUIRED

Reason: This proposal coordinates the wind design criteria in the IRC with currently referenced 2016 edition of the loading standard *ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 7-16).
There are two primary proposed changes to the IRC for coordination with the revised wind loading criteria in ASCE 7-16: (1) updated basic wind speed maps for Risk Category II buildings and (2) revised roof component and cladding loads for buidings with mean roof heights less than or equal to 60 feet.

(1) Updated Map:

In ASCE 7-16, wind speeds in non-hurricane prone areas of the contiguous United States have been revised using contours to better reflect the regional vairation in the extreme wind climate. Point values are provided to aid interpolation, in a style similar to that used for the other hazard maps in ASCE 7. Summaries of the datat and methods used to estiimate both the non-hurriane and hurricanewind speeds are provided in the Commentary to ASCE 7-16 Chpater 26 (attached to this proposal). The wind speeds in the hurricane-prone region have not changed from ASCE 7-10, the previous edition. Revised Figure R301.2(4)A is the wind speed map from ASCE 7-16 for Risk Category II Buildings.

Update to R301.2(4)B removes the notes, only.

(2) Revised Tables:

The simplified component and cladding loads in Table R301.2(2) are proposed to be revised for correlation with the new roof component and cladding loads for buildings with mean roof heights less than or equal to 60 feet. The roof zones and pressure coefficients in ASCE 7-16 Figure 30.4-2 (which includes Figures 30.4-2A through

30.4-2I) have been revised based on an analysis of an extensive wind tunnel database. All source data used in the study are publically accessible throught the National Institiute of Standards and Technology (NIST) website. Compared to previous versions of ASCE 7, the pressure coefficients have been increased, and are now more consistent with coefficients for buildings higher than 60 feet. Roof zones sizes are also modified from those of earlier versions in order to minimize the increase of pressure coefficients in Zones 1 and 2. The data indicate that for these low-rise buildings, the size of the roof zones depend primarilly on the builing height, h. The GCp values given in ASCE 7-16 Figures 30.4-2A through 30.4-2I are associated with wind tunnel tests perfomed in both Exposure B and C. For ASCE 7-16 Figure 30.4-2A, the coefficients applly equally to Exposure B and C, based on wind tunnel data that show insignificant difference in (GCp) for Exposure B and C. Consequently, the truncation for Kz in Table 30.3-1 of ASCE 7-10 is not requiredfor buiding below 30 feet, and the lower Kz values may be used as hown revised in Figure R301.2(3) of the IRC. More explaination is found in the Commentary to ASCE 7-16 Chapter 30 (attached to this proposal).

NOTE: Due to cdpAccess functionality, the revised table was added as a NEW table, however, it is intended to replace the existing R301.2(2). Also, in the NEW table, only footnotes f and g are NEW. The footnotes a to e remain unchanged from previous IRC, but only look new due to cdpAccess legislative format editor.

Cost Impact: The code change proposal will increase the cost of construction
Component and cladding loads for roofs in buildings with mean roof heights less than or equalt to 60 feet are higher for some roof slopes and zones than for similar roof slopes in 2018 IRC. Construction costs will increase for roofing products and decking for some areas of the country in the hurricane-prone region. However, for much of the country outside the hurricane-prone region, the wind speeds are actually lower and therefore even with an increase in GCp, the loads do not change and there is no impact on costs.Also, loads for wall components such as windows, doors, siding, etc., are lower for mean roof height under 30 feet. Loads on Main Wind Force Resisting Systems, such as shear walls and diaphragms, are decreasing in areas where the design wind speed has decreased.

Proposal # 5220

RB35-19

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B1709.5.2-18

IBC®: 1709.5.2, 1709.5.2.1 (New)

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Building Code

1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM ~~E330. Structural performance of garage doors and rolling doors shall be determined in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.~~ E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

Revise as follows:

1709.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the pass/fail acceptance criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be *labeled* with a permanent *label* identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

Reason Statement: This would clarify that garage doors must be labeled and defines performance standards.

Bibliography: This proposal will neither increase nor decrease Resiliency
No effect

Cost Impact: The code change proposal will not increase or decrease the cost of construction
No cost effect.

RB609.4-18

IRC®: R609.4, R609.4.1 (New)

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Residential Code

R609.4 Garage doors. Garage doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the ~~acceptance~~ pass/fail criteria of ANSI/DASMA 108.

Revise as follows:

R609.4.1 Garage door labeling. Garage doors shall be *labeled* with a permanent *label* affixed to the garage door by the manufacturer. The *label* shall identify the garage door manufacturer, the garage door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

Reason Statement: The proposal requires labeled to be affixed and lays out design standards.

Bibliography: This proposal will increase Resiliency
This sets design standards for garage doors

Cost Impact: The code change proposal will increase the cost of construction
It requires additional documentation.

Soffit Proposal for the 2021 VRC

Revise as follows:

R703.11.1 Installation. Vinyl siding~~, soffit~~ and accessories shall be installed in accordance with manufacturer's instructions.

~~**R703.11.1.4 Vinyl soffit panels.** Soffit panels shall be individually fastened to a supporting component such as a nailing strip, fascia, or subfascia component or as specified by the manufacturer's instructions.~~

Add new section as follows:

SECTION R704

SOFFITS

R704.1 General wind limitations. Where the design wind pressure is 30 psf or less, soffits shall comply with Section R704.2. Where the design wind pressure exceeds 30 psf, soffits shall comply with Section R704.3. The design wind pressure on soffits shall be determined using the component and cladding loads specified in Table R301.2(2) for walls with an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

R704.2 Soffit installation where the design wind pressure is 30 psf and less. Soffit installation shall comply with Section R704.2.1, Section R704.2.2, Section R704.2.3, or Section R704.2.4. Soffit materials not addressed in Sections R704.2.1through R704.2.4 shall be in accordance with the manufacturer's installation instructions.

R704.2.1 Vinyl soffit panels. Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 16 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

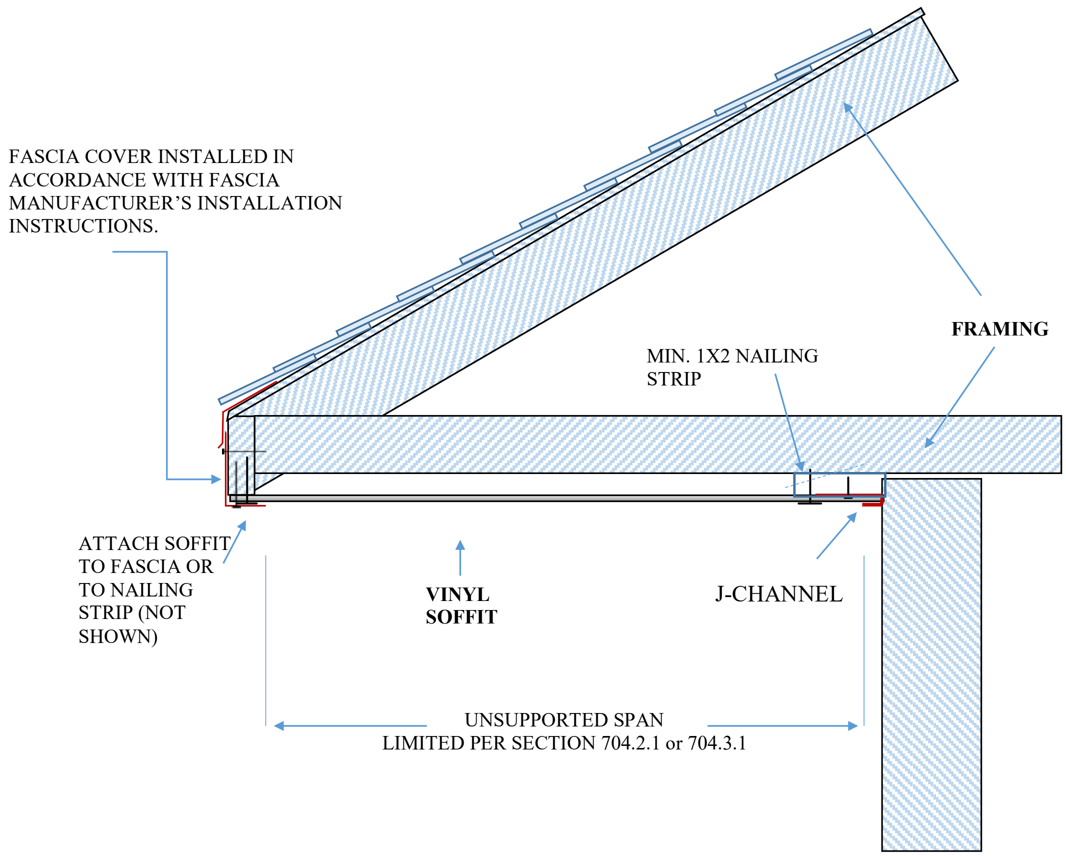


Figure R704.2.1 Typical single span vinyl soffit panel support

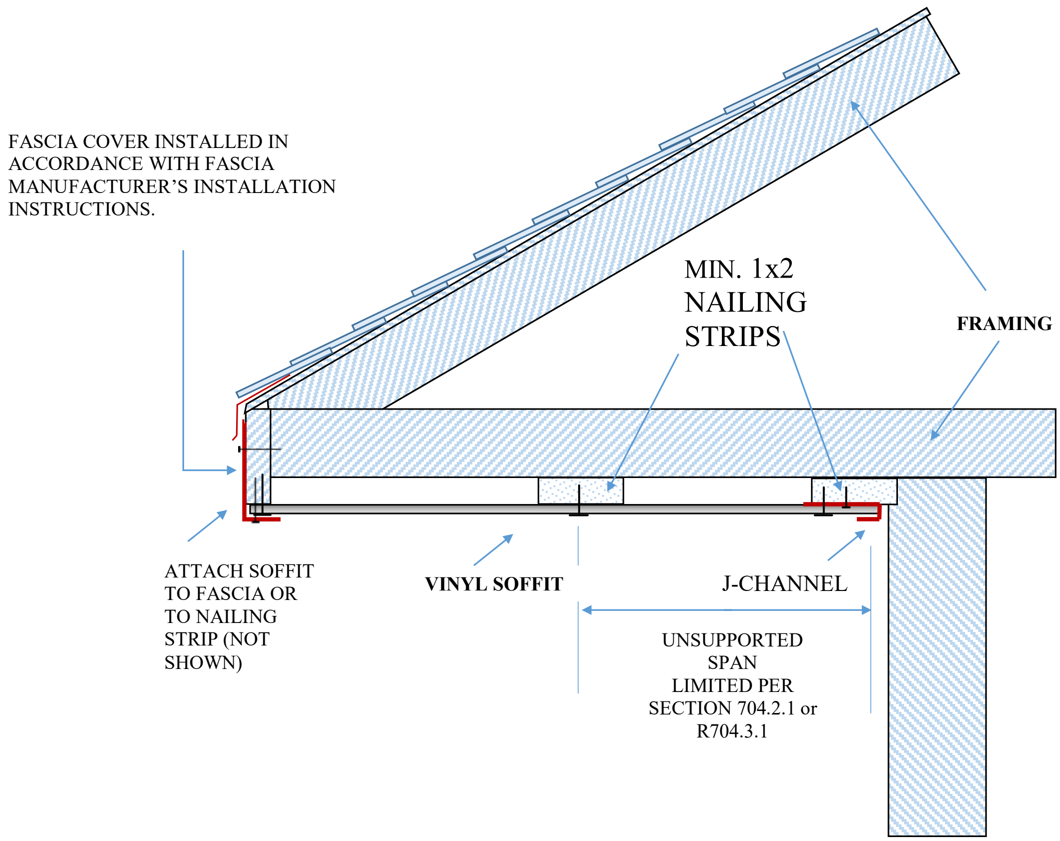


Figure R704.2.2 Typical double span vinyl soffit panel support

R704.2.2 Fiber-cement soffit panels. Fiber-cement soffit panels shall be a minimum of 1/4 inch in thickness and shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panel joints shall occur over framing or over wood structural panel sheathing. Soffit panels shall be installed with spans and fasteners in accordance with the manufacturer's installation instructions.

R704.2.3 Hardboard soffit panels. Hardboard soffit panels shall be a minimum of 7/16 inch in thickness and shall be fastened to framing or nailing strips with 2 ½ " x 0.113" siding nails spaced not more than 6 inches on center at panel edges and 12 inches on center at intermediate supports.

R704.2.4 Wood structural panel soffit. The minimum nominal thickness for wood structural panel soffits shall be 3/8 inch (9.5 mm) and shall be fastened to framing or nailing strips with 2-inch by 0.099-inch (51 mm x 2.5 mm) nails. Fasteners shall be spaced not less than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) on center at intermediate supports.

R704.3 Soffit installation where the design wind pressure exceeds 30 psf. Soffit installation shall comply with Section R704.3.1, Section R704.3.2, Section R704.3.3, or Section R704.3.4. Soffit materials not addressed in Sections R704.3.1 through R704.3.4 shall be in accordance with the manufacturer's installation instructions.

R704.3.1 Vinyl soffit panels. Vinyl soffit panels and their attachments shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia, or subfascia component in accordance with Figure R704.2.1. Where the unsupported span of soffit panels is greater than 12 inches, intermediate nailing strips shall be provided in accordance with Figure R704.2.2. Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

R704.3.2 Fiber-cement soffit panels. Fiber-cement soffit panels shall comply with Section R704.2.2 and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

R704.3.3 Hardboard soffit panels. Hardboard soffit panels shall comply with the manufacturer's installation instructions and shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3).

R704.3.4 Wood structural panel soffits. Wood structural panel soffits shall be capable of resisting wind loads specified in Table R301.2(2) for walls using an effective wind area of 10 square feet and adjusted for height and exposure in accordance with Table R301.2(3). Alternatively, wood structural panel soffits shall be permitted to be installed in accordance with Table R704.3.4.

Table 704.3.4

Prescriptive Alternative for Wood Structural Panel, Closed Soffit[b,c,d,e,f]

Maximum Design Pressure (- or + psf)	Minimum Panel Span Rating	Minimum Panel Performance Category	Nail Type and Size (inch)	Fastener[a] Spacing along Edges and Intermediate Supports (inch)	
				Galvanized Steel	Stainless Steel
30	24/0	3/8	6d box (2 x 0.099 x 0.266 head diameter)	6[f]	4
40	24/0	3/8	6d box (2 x 0.099 x 0.266 head diameter)	6	4
50	24/0	3/8	6d box (2 x 0.099 x 0.266 head diameter)	4	4
			8d common (2½ x 0.131 x 0.281 head diameter)	6	6
60	24/0	3/8	6d box (2 x 0.099 x 0.266 head diameter)	4	3
			8d common (2½ x 0.131 x 0.281 head diameter)	6	4
70	24/16	7/16	8d common (2½ x 0.131 x 0.281 head diameter)	4	4
			10d box (3 x 0.128 x 0.312 head diameter)	6	4
80	24/16	7/16	8d common (2½ x 0.131 x 0.281 head diameter)	4	4
			10d box (3 x 0.128 x 0.312 head diameter)	6	4
90	32/16	15/32	8d common (2½ x 0.131 x 0.281 head diameter)	4	3
			10d common (3 x 0.148 x 0.312 head diameter)	6	4

a. Fasteners shall comply with Sections R703.3.2 and R703.3.3.
b. Maximum spacing of soffit framing members shall not exceed 24 inches.
c. Wood structural panels shall be of an exterior exposure grade.
d. Wood structural panels shall be installed with strength axis perpendicular to supports with a minimum of two continuous spans.
e. Wood structural panels shall be attached to soffit framing members with specific gravity of at least 0.42. Framing members shall be minimum 2x3 nominal with the larger dimension in the cross section aligning with the length of fasteners to provide sufficient embedment depths.
f. Spacing at intermediate supports is permitted to be 12 inches on center.

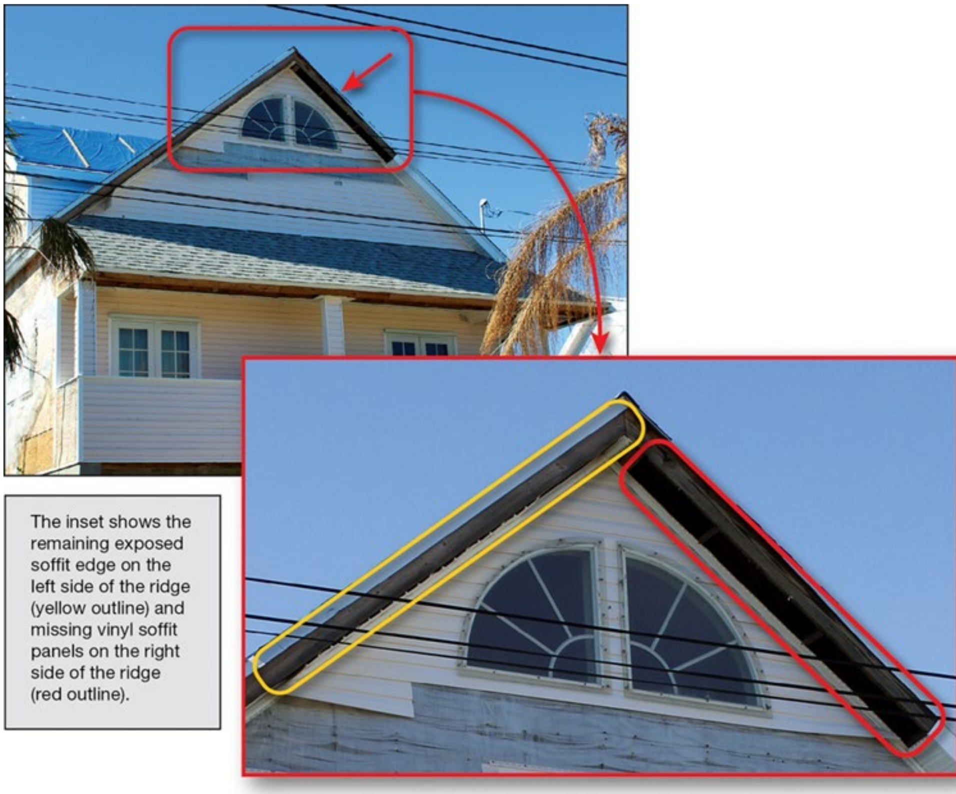
Reasons Statement: The purpose of this code change proposal is to improve the wind performance of soffits by clarifying International Residential Code (IRC) installation requirements for the most common types of manufactured soffits and by providing a prescriptive alternative for wood structural panel soffits that complies with design wind pressures specified in the IRC and ASCE 7. The code change refines and further clarifies provisions that were adopted into the 2018 IRC and adds new provisions to address soffit installation in high wind regions. The proposal also moves the clarified soffit provisions to the new Section 704 to better distinguish from exterior wall covering provisions that make up nearly all of Section 703. In addition to separating the clarified soffit provisions to prevent them from being overlooked, new soffit provisions can easily be added as needed with this improved organization and simplified format.

As part of the response to Hurricane Harvey in Texas and Hurricane Irma in Florida, the Federal Emergency Management Agency (FEMA) deployed Mitigation Assessment Teams (MATs) composed of national and regional building science experts to assess the damage in both States. The primary purpose of a MAT is to improve the natural hazard resistance of buildings by evaluating the key causes of building damage, failure, and success, and developing strategic recommendations for improving short-term recovery and long-term disaster resilience from future natural hazard events. The following MAT-related information is included in the FEMA MAT Reports: Hurricane Irma in Florida (https://www.fema.gov/media-library/assets/documents/176315) and Hurricane Harvey in Texas (https://www.fema.gov/media-library/assets/documents/177700).

The FL MAT observed building envelope damage on both older and newer residential construction, and soffits were among the most frequently observed damaged envelope components. Based on estimated wind speeds at the sites visited, failure occurred to soffit components at wind speeds well below design wind speeds for these areas. The FL MAT observed both vinyl and metal soffit loss, but vinyl soffit panels were the most common product observed, particularly in the Florida Keys where vinyl soffit damage was widespread.

In many cases, inadequate support and attachment at the ends of the soffit panel led to failure of the soffit. The Sugarloaf Key house shown below (FL MAT Report Figure 4-19) lost its vinyl soffit in several areas. The red oval shows where the soffit panel was stripped from the assembly's J-channel, which remains attached along the exterior wall (yellow arrows). The soffit appears to have been fastened to only a single nailing strip across the midpoint of the framing above. Section 704.2.1 (including Figure 704.2.1) of the proposal has been included to clarify that vinyl soffit panels are required to be fastened at each end and the unsupported span cannot exceed specified limits (16 or 12 inches) unless permitted by the manufacturer's product approval.

In some cases, vinyl soffit failure appeared to have been associated with fascia cover loss as shown in the image below from Little Torch Key (FL MAT Report Figure 4-18). Loss of the fascia cover likely increases wind pressures on vinyl soffit where the edges of the soffit are exposed.



The inset shows the remaining exposed soffit edge on the left side of the ridge (yellow outline) and missing vinyl soffit panels on the right side of the ridge (red outline).

The TX MAT observed similar wind damage to residential soffits as indicated below. The dwelling in Cape Valero shown on the left (TX MAT Figure 4-44) lost re-covered vinyl soffit panels (green arrow) to high winds, exposing the vent opening (red arrows) to wind driven rain. The photo on the right (TX MAT Figure 4-45) shows a soffit opening that was previously covered by a ventilating fiber-cement board. Red arrows indicate where the attic is exposed to wind driven rain. As with examples shown from Florida, estimated wind speeds for the sites were below design wind speeds.

FL and TX MAT observations described above along with other examples detailed in the MAT Reports, led to the following conclusions and recommendations:

Conclusion FL-10: The MAT observed evidence of inadequate resistance to wind pressures and improper installation of soffits on residential buildings. Widespread loss of soffits was observed in residential construction, and wind-driven rain infiltrated some areas where soffits were displaced or lost.
Recommendation FL-10a: Designers, contractors, and inspectors should place more emphasis on proper soffit installation to limit wind-driven rain. Proper soffit installation should be emphasized by designers, contractors, and inspectors in order to limit wind-driven rain from entering building envelopes and damaging building interiors.
Conclusion TX-18*:* Many soffits lacked adequate wind resistance, typically because the wrong material was used for the region or it was improperly installed. The MAT observed widespread loss of soffits in residential and non-residential construction, generally due to improper materials, lack of fasteners, and/or inadequate framing, and wind-driven rain infiltrated some areas where soffits were displaced or lost. The loss of soffit vents can allow hurricane winds to drive large amounts of water through the openings and soak insulation, which can lead to mold growth and, in some cases, the collapse of ceilings.
Recommendation TX-18: Designers, contractors, and inspectors should place more emphasis on proper soffit installation in high-wind regions. Wind-driven rain should be limited from entering building envelopes and damaging building interiors through proper soffit installation.

In summary, widespread residential soffit damage observed in the wake of the 2017 Hurricane Season indicates the need for clarified installation provisions in the IRC. The proposed provisions apply to design wind pressures realized across the US, but are clearly differentiated where 30 pounds per square foot (psf) or less or where greater than 30 psf, so that installation requirements are tailored for the site-specific pressures. Regardless the soffit design wind pressure, the new provisions will provide greater clarity for the builder to implement code-compliant soffit installation and for the building official to verify code-compliant soffit installation.

Cost Impact: The code change proposal will not increase the cost of construction for buildings where design wind pressures are 30 psf or less because it only clarifies the existing requirements for soffit installation. The code change proposal may decrease costs for buildings where the design wind pressure exceeds 30 psf because it provides code compliant solutions in lieu of design.

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RB301.2.1.1-18

IRC®: R301.2.1.1

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Residential Code

R301.2.1.1 Wind limitations and wind design required. The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure ~~R301.2(5)B.~~ R301.2(5)B or where the ultimate design wind speed, V_{alt} in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region.

Exceptions:

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R608.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R610.
3. For cold-formed steel light-frame construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R505, R603 and R804.

In regions where wind design is required in accordance with Figure R301.2(5)B or where the ultimate design wind speed V_{alt} in Figure R301.2(5)A equals or exceeds 140 mph in a special wind region, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AWC *Wood Frame Construction Manual* (WFCM).
2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).
4. AISI *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings* (AISI S230).
5. International Building Code.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code.

Where ASCE 7 or the International Building Code is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the International Building Code shall be used.

Reason Statement: Special wind region adopts the 2021 cycle changes.

Bibliography: This proposal will increase Resiliency
This proposal increases resiliency

Cost Impact: The code change proposal will increase the cost of construction
Alters wind design criteria which could alter the cost of construction.

RB200-18

IEBC®: [BS]; IRC®: 1 (New), (New)

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2018 International Existing Building Code

[BS] SUBSTANTIAL DAMAGE. For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[BS] SUBSTANTIAL IMPROVEMENT.

For the purpose of determining compliance with the flood provisions of this code, any *repair*, *alteration*, *addition*, or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage*, any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary, or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

2018 International Residential Code

Add new text as follows:

SUBSTANTIAL DAMAGE For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

SUBSTANTIAL IMPROVEMENT For the purpose of determining compliance with the flood provisions of this code, any *repair* , *alteration* , *addition* , or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage* , any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary, or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

Reason Statement: Mirrors definitions from the IEBC to the IRC

Bibliography: This proposal will neither increase nor decrease Resiliency
This is primarily to comply with flood regulations.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is primarily to comply with flood regulations.

A109.3-18

VCC: 109.3

Proponents: Thomas King (thomas.king@dhcd.virginia.gov); Rebecca Quinn (rcquinn@earthlink.net)

2015 Virginia Construction Code

Revise as follows:

109.3 Engineering details. When determined necessary by the building official, *construction* documents shall include adequate detail of the structural, mechanical, plumbing or electrical components. Adequate detail may include computations, stress diagrams or other essential technical data and when proposed buildings are more than two stories in height, adequate detail may specifically be required to include where floor penetrations will be made for pipes, wires, conduits, and other components of the electrical, mechanical and plumbing systems and how such floor penetrations will be protected to maintain the required structural integrity or fire-resistance rating, or both. ~~All~~ When dry floodproofing is proposed, the engineering details shall include adequate detail of the walls, floors, and flood shields designed to resist flood-related loads, with particular attention to sealing of floor and wall penetrations. All engineered documents, including relevant computations, shall be sealed by the RDP responsible for the design.

Reason Statement: Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Having site plans include flood hazard information improves review efficiency. FEMA post-flood investigations of dry floodproofed buildings identify frequent failures where walls and floors are penetrated by pipes, wires, conduits, etc.

A113.3-18

VCC: 113.3

Proponents: Thomas King (thomas.king@dhcd.virginia.gov)

2015 Virginia Construction Code

113.3 Minimum inspections. The following minimum inspections shall be conducted by the building official when applicable to the *construction* or permit:

1. Inspection of footing excavations and reinforcement material for concrete footings prior to the placement of concrete.
2. Inspection of foundation systems during phases of *construction* necessary to assure compliance with this code.
3. Inspection of preparatory work prior to the placement of concrete.
4. Inspection of the elevation of the lowest floor and prior to further vertical construction, upon submission of certification of the elevation of the lowest floor to the building official, for construction in flood hazard areas.
5. Inspection of structural members and fasteners prior to concealment.
6. Inspection of electrical, mechanical and plumbing materials, equipment and systems prior to concealment.
7. Inspection of energy conservation material prior to concealment.
8. Inspection of the elevation of the lowest floor in accordance with Section 110.3.10.1 prior to final inspection located in any flood hazard area or special flood hazard area.
9. Final inspection.

Reason Statement: Staff proposal build to break into pieces George Homewood's resiliency proposals.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
These provisions primarily concern with compliance with NFIP and using similar language.

A117.2-18

VCC: 117.2

Proponents: Thomas King (thomas.king@dhcd.virginia.gov); Rebecca Quinn (rcquinn@earthlink.net)

2015 Virginia Construction Code

Revise as follows:

117.2 Moved buildings and structures. Any *building* or *structure* moved into a *locality* or moved to a new location within a *locality* shall not be occupied or used until ~~a certificate~~ the flood hazard documentation has been approved by the building official if required by Section 1612.5 and a certificate of occupancy is issued for the new location. Such moved buildings or *structures* shall be required to comply with the requirements of the VEBC.

Reason Statement: This alters the CO approval process for flood hazard areas.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not have any effect on cost.