

**This document contains excerpts of the wind provisions from the 2015 edition of the IRC.**

**2015 International Residential Code®  
[A compilation of wind resistant provisions, prepared by FEMA]**

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**Note to Reader:** This document provides the wind resistant provisions of the 2015 International Residential Code and is not intended to be a compilation of all the structural and non-structural provisions of the IRC®. Where material that was not specific to wind was removed from a code section, “partial shown” is indicated. Where a “user note” or information that may be useful to the reader is provided, it is provided in blue text. A description of applicable figures to the wind resistant provisions are provided in italicized text and the figure can be seen in the full publication of the IRC.

**IRC  
2015 International Residential Code**

**EFFECTIVE USE OF THE INTERNATIONAL RESIDENTIAL CODE**

The International Residential Code (IRC) was created to serve as a complete, comprehensive code regulating the construction of single-family houses, two-family houses (duplexes) and buildings consisting of three or more townhouse units. All buildings within the scope of the IRC are limited to three stories above grade plane. *[partial shown]*

*User Note:* The chapters shown below are those that are highlighted in this document and provide wind resistant provisions.

**Chapter 2 Definitions.** Terms defined in the code are listed alphabetically in Chapter 2. *[partial shown]*

**Chapter 3 Building Planning.** Chapter 3 provides guidelines for a minimum level of structural integrity, life safety, fire safety and livability for inhabitants of dwelling units regulated by this code. Chapter 3 is a compilation of the code requirements specific to the building planning sector of the design and construction process. This chapter sets forth code requirements dealing with light, ventilation, sanitation, minimum room size, ceiling height, and environmental comfort. Chapter 3 establishes life-safety provisions including limitations on glazing used in hazardous areas, specifications on stairways, use of guards at elevated surfaces, window and fall protection, and rules for means of egress. Snow, wind, and seismic design live and dead loads and flood-resistant

construction, as well as solar energy systems, and swimming pools, spas, and hot tubs, are addressed in this chapter.

**Chapter 4 Foundations.** Chapter 4 provides the requirements for the design and construction of foundation systems for buildings regulated by this code. Provisions for seismic load, flood load and frost protection are contained in this chapter. *[partial shown]*

**Chapter 5 Floors.** Chapter 5 provides the requirements for the design and construction of floor systems that will be capable of supporting minimum required design loads. *[partial shown]*

**Chapter 6 Wall Construction.** Chapter 6 contains provisions that regulate the design and construction of walls. The wall construction covered in Chapter 6 consists of five different types: wood framed, cold-formed steel framed, masonry, concrete and structural insulated panel (SIP). The primary concern of this chapter is the structural integrity of wall construction and transfer of all imposed loads to the supporting structure. This chapter provides the requirements for the design and construction of wall systems that are capable of supporting the minimum design vertical loads (dead, live and snow loads) and lateral loads (wind or seismic loads). This chapter contains the prescriptive requirements for wall bracing and/or shear walls to resist the imposed lateral loads due to wind and seismic.

Chapter 6 also regulates exterior windows and doors installed in walls. The chapter contains criteria for the performance of exterior windows and doors and includes provisions for testing and labeling, garage doors, wind-borne debris protection and anchorage details.

**Chapter 7 Wall Covering.** Chapter 7 contains provisions for the design and construction of interior and exterior wall coverings. This chapter establishes the various types of materials, materials standards and methods of application permitted for use as interior coverings, including interior plaster, gypsum board, ceramic tile, wood veneer paneling, hardboard paneling, wood shakes and wood shingles. Chapter 7 also contains requirements for the use of vapor retarders for moisture control in walls.

Exterior wall coverings provide the weather-resistant exterior envelope that protects the building's interior from the elements. Chapter 7 provides the requirements for wind resistance and water-resistive barrier for exterior wall coverings. This chapter prescribes the exterior wall coverings as well as the water-resistive barrier required beneath the exterior materials. Exterior wall coverings regulated by this section include aluminum, stone and masonry veneer, wood, hardboard, particleboard, wood structural panel siding, wood shakes and shingles, exterior plaster, steel, vinyl, fiber cement and exterior insulation finish systems.

**Chapter 8 Roof-ceiling Construction.** Chapter 8 regulates the design and construction of roof-ceiling systems. This chapter contains two roof-ceiling framing systems: wood framing and cold-formed steel framing. Allowable span tables are

provided to simplify the selection of rafter and ceiling joist size for wood roof framing and cold-formed steel framing. *[partial shown]*

**Chapter 9 Roof Assemblies.** Chapter 9 regulates the design and construction of roof assemblies. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings.

The types of roof covering materials and installation regulated by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.

**Chapter 44 Referenced Standards.** The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 44 contains a comprehensive list of all standards that are referenced in the code. *[partial shown]*

**Appendix E Manufactured Housing Used as Dwellings.** The criteria for the construction of manufactured homes are governed by the National Manufactured Housing Construction and Safety Act. *[partial shown]*

**Appendix H Patio Covers.** Appendix H sets forth the regulations and limitations for patio covers. The provisions address those uses permitted in patio cover structures, the minimum design loads to be assigned for structural purposes, and the effect of the patio cover on egress and emergency escape or rescue from sleeping rooms. This appendix also contains the special provisions for aluminum screen enclosures in hurricane-prone regions.

**Appendix R Light Straw-Clay Construction.** This appendix regulates the use of light straw-clay as a construction material. It is limited in application to nonbearing wall infill systems.

**Appendix S Strawbale Construction.** This appendix provides prescriptive requirements for the use of strawbale as a construction material. It is limited in application to the walls of one-story structures, except where additional engineering is provided.

## CHAPTER 2 DEFINITIONS

### SECTION R202 DEFINITIONS

**[RB] BASIC WIND SPEED.** Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section R301.2.1) as given in Figure R301.2(4)A.

**[RB] CLADDING.** The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

**[RB] ESCARPMENT.** With respect to topographic wind effects, a cliff or steep slope generally separating two levels or gently sloping areas.

**[RB] HILL.** With respect to topographic wind effects, a land surface characterized by strong relief in any horizontal direction.

**[RB] HURRICANE-PRONE REGIONS.** Areas vulnerable to hurricanes, defined as the U.S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed,  $V_{ult}$ , is greater than 115 miles per hour (51 m/s), and Hawaii, Puerto Rico, Guam, Virgin Islands and America Samoa.

**[RB] RIDGE.** With respect to topographic wind effects, an elongated crest of a hill characterized by strong relief in two directions.

**[RB] SHEAR WALL.** A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with Chapter 6 of this code and the associated limitations in Section R301.2 of this code.

**[RB] WINDBORNE DEBRIS REGION.** Areas within hurricane-prone regions located in accordance with one of the following:

1. Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed,  $V_{ult}$ , is 130 mph (58 m/s) or greater.
2. In areas where the ultimate design wind speed,  $V_{ult}$ , is 140 mph (63.6 m/s) or greater; or Hawaii.

## CHAPTER 3 BUILDING PLANNING

### SECTION R301 DESIGN CRITERIA

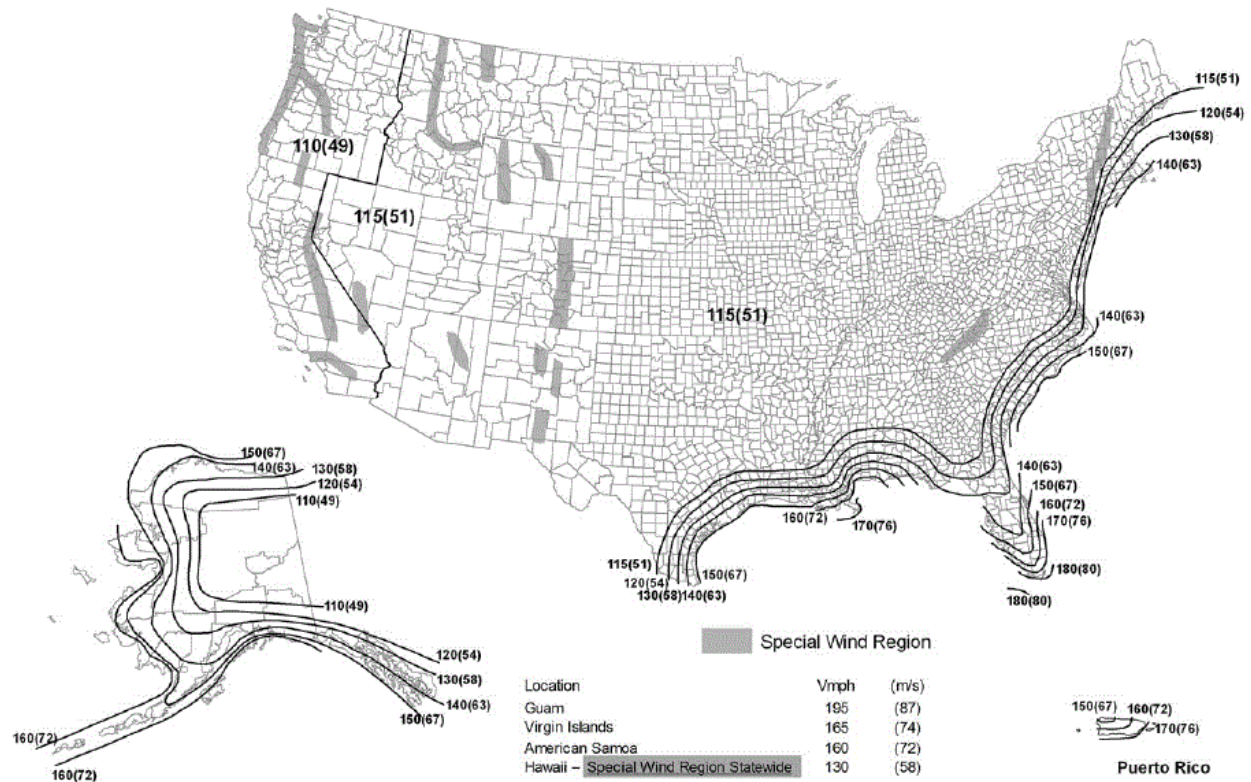
**R301.2 Climatic and geographic design criteria.** Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria shall be established by the local jurisdiction and set forth in Table R301.2(1).

*Table R301.2(1). Provides the climatic and geographic design criteria.*

*Table R301.2(2). Provides component and cladding loads for a building with a mean roof height of 30 feet located in exposure B. This Table references Table R301.2(7), which defines the zones listed in Table R301.2(2).*

*Table R301.2(3). Provides height and exposure adjustment coefficients for Table R301.2(2).*

**R301.2.1 Wind design criteria.** Buildings and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design wind speed in Table R301.2(1) as determined from Figure R301.2(4)A. The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1. Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11.1 from the roof assembly to the foundation.



- 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 between contours is permitted.
  3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
  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).

## FIGURE R301.2(4)A. ULTIMATE DESIGN WIND SPEEDS

**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(4)B.

### 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.

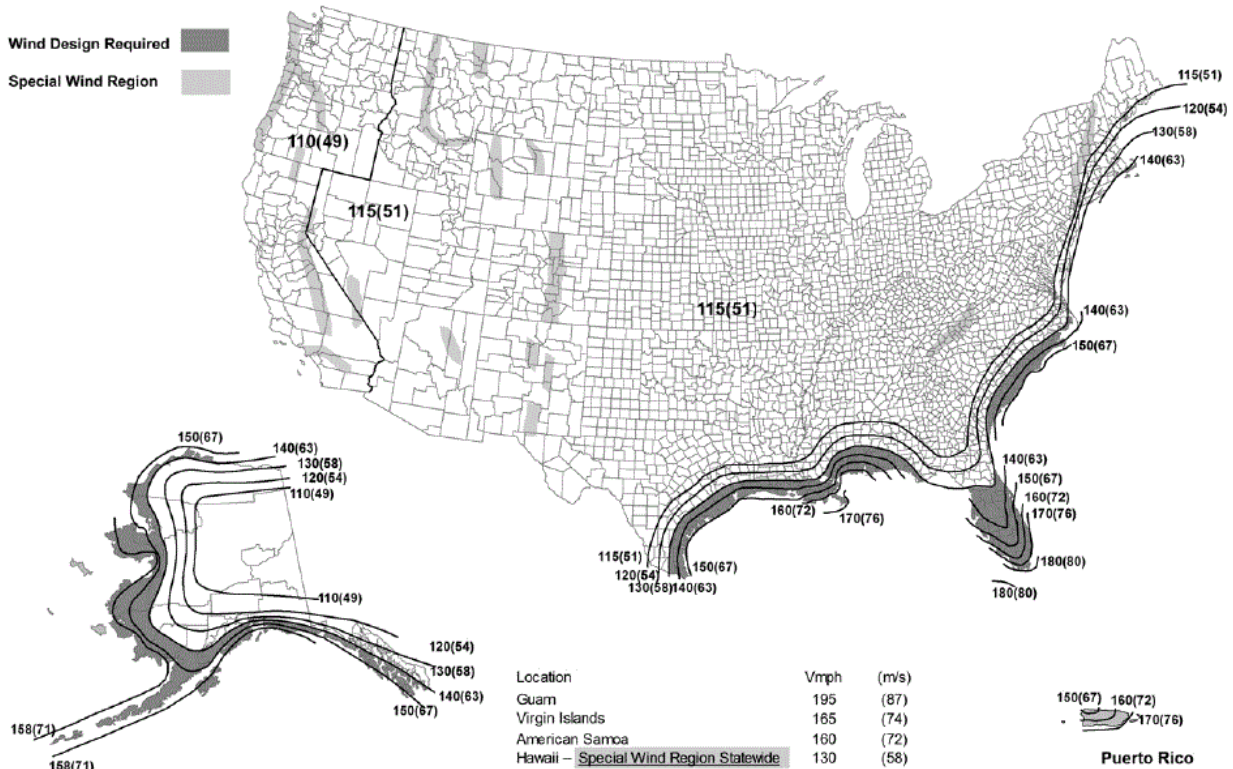
In regions where wind design is required in accordance with Figure R301.2(4)B, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AF&PA 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.



**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 between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
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).

**FIGURE R301.2(4)B. REGIONS WHERE WIND DESIGN IS REQUIRED**

**R301.2.1.1.1 Sunrooms.** Sunrooms shall comply with AAMA/NPEA/NSA 2100. For the purpose of applying the criteria of AAMA/NPEA/NSA 2100 based on the intended use, sunrooms shall be identified as one of the following categories by the permit applicant, design professional or the property owner or owner's agent in the construction documents. Component and cladding pressures shall be used for the design of elements that do not qualify as main windforce-resisting systems. Main windforce-resisting system pressures shall be used for the design of elements assigned to provide support and stability for the overall sunroom.

**Category I:** A thermally isolated sunroom with walls that are open or enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is nonhabitable and unconditioned.

**Category II:** A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The space is nonhabitable and unconditioned.

**Category III:** A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The sunroom fenestration complies with additional requirements for air infiltration resistance and water penetration resistance. The space is nonhabitable and unconditioned.

**Category IV:** A thermally isolated sunroom with enclosed walls. The sunroom is designed to be heated or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is nonhabitable and conditioned.

**Category V:** A sunroom with enclosed walls. The sunroom is designed to be heated or cooled and is open to the main structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is habitable and conditioned.

**R301.2.1.2 Protection of openings.** Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

**Exception:** Wood structural panels with a thickness of not less than  $\frac{7}{16}$  inch (11 mm) and a span of not more than 8 feet (2438 mm) shall be permitted for opening protection. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2(2) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors



permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 45 feet (13, 728 mm) or less where the ultimate design wind speed,  $V_{ult}$ , is 180 mph (290 kph) or less.

**R301.2.1.2.1 Application of ASTM E 1996.** The text of Section 2.2 of ASTM E 1996 shall be substituted as follows:

2.2 ASCE Standard:

ASCE 7-10 American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures

The text of Section 6.2.2 of ASTM E 1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the ultimate design wind speed,  $V_{ult}$ , as follows:

6.2.2.1 Wind Zone 1—130 mph  $\leq$  ultimate design wind speed,  $V_{ult} < 140$  mph.

6.2.2.2 Wind Zone 2—140 mph  $\leq$  ultimate design wind speed,  $V_{ult} < 150$  mph at greater than 1 mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 Wind Zone 3—150 mph (58 m/s)  $\leq$  ultimate design wind speed,  $V_{ult} \leq 170$  mph (76 m/s), or 140 mph (54 m/s)  $\leq$  ultimate design wind speed,  $V_{ult} \leq 170$  mph (76 m/s) and within 1 mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 Wind Zone 4—ultimate design wind speed,  $V_{ult} > 170$  mph (76 m/s).

*Table R301.2.1.2. Provides windborne debris protection fastening schedule for wood structural panels.*

**R301.2.1.3 Wind speed conversion.** Where referenced documents are based on nominal design wind speeds and do not provide the means for conversion between ultimate design wind speeds and nominal design wind speeds, the ultimate design wind speeds,  $V_{ult}$ , of Figure R301.2(4)A shall be converted to nominal design wind speeds,  $V_{asd}$ , using Table R301.2.1.3.

**TABLE R301.2.1.3. WIND SPEED CONVERSIONS<sup>a</sup>**

$V_{ult}$	110	115	120	130	140	150	160	170	180	190	200
$V_{asd}$	85	89	93	101	108	116	124	132	139	147	155

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

a. Linear interpolation is permitted.

**R301.2.1.4 Exposure category.** For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, townhouses or other structures are to be constructed as part of a subdivision or master-planned community, or are otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based upon the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided that their construction is expected to begin within one year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. Exposure B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
2. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat, open country and grasslands.
3. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water, smooth mud flats, salt flats and unbroken ice for a distance of not less than 5,000 feet (1524 m). This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the unobstructed area. Exposure D extends downwind from the edge of the unobstructed area a distance of 600 feet (183 m) or 20 times the height of the building or structure, whichever is greater.

**R301.2.1.5 Topographic wind effects.** In areas designated in Table R301.2(1) as having local historical data documenting structural damage to buildings caused by wind speed-up at isolated hills, ridges and escarpments that are abrupt changes from the general topography of the area, topographic wind effects shall be considered in the design of the building in accordance with Section R301.2.1.5.1 or in accordance with the provisions of ASCE 7. See Figure R301.2.1.5.1(1) for topographic features for wind speed-up effect.

In these designated areas, topographic wind effects shall apply only to buildings sited on the top half of an isolated hill, ridge, or escarpment where all of the following conditions exist:

1. The average slope of the top half of the hill, ridge or escarpment is 10 percent or greater.
2. The hill, ridge or escarpment is 60 feet (18 288 mm) or greater in height for Exposure B, 30 feet (9144 mm) or greater in height for Exposure C, and 15 feet (4572 mm) or greater in height for Exposure D.
3. The hill, ridge or escarpment is isolated or unobstructed by other topographic features of similar height in the upwind direction for a distance measured from its high point of 100 times its height or 2 miles (3.2 km), whichever is less. See Figure R301.2.1.5.1(3) for upwind obstruction.
4. The hill, ridge or escarpment protrudes by a factor of two or more above the height of other upwind topographic features located in any quadrant within a radius of 2 miles (3.2 km) measured from its high point.

*Figure R301.2.1.5.1(1). Image provides the topographic features for wind speed-up effect.*

*Figure R301.2.1.5.1(3). Image provides depiction of upwind obstruction*

**R301.2.1.5.1 Simplified topographic wind speed-up method.** As an alternative to the ASCE 7 topographic wind provisions, the provisions of Section R301.2.1.5.1 shall be permitted to be used to design for wind speed-up effects, where required by Section R301.2.1.5.

Structures located on the top half of isolated hills, ridges or escarpments meeting the conditions of Section R301.2.1.5 shall be designed for an increased basic wind speed as determined by Table R301.2.1.5.1. On the high side of an escarpment, the increased basic wind speed shall extend horizontally downwind from the edge of the escarpment 1.5 times the horizontal length of the upwind slope (1.5L) or 6 times the height of the escarpment (6H), whichever is greater. See Figure R301.2.1.5.1(2) for where wind speed increase is applied.

*Table R301.2.1.5.1. Provides ultimate design wind speed modification for topographic wind effect.*

*Figure R301.2.1.5.1(2). Image provides illustration of where on a topographic feature, wind speed increase is applied.*

**User Note:** Section R301.2.4 does not contain wind provisions but is included for the reference to substantial damage.

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

**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).
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 greater 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 greater 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).

Individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided that story heights 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.

**R301.7 Deflection.** The allowable deflection of any structural member under the live load listed in Sections R301.5 and R301.6 or wind loads determined by Section R301.2.1 shall not exceed the values in Table R301.7.

*Table R301.7. Provides the allowable deflection of structural members.*

[User Note: Section R322 does not contain wind provisions but is included because it references substantial damage.](#)

## **SECTION R322 FLOOD-RESISTANT CONSTRUCTION**

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

most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

### **SECTION R323 STORM SHELTERS**

**R323.1 General.** This section applies to storm shelters where constructed as separate detached buildings or where constructed as safe rooms within buildings for the purpose of providing refuge from storms that produce high winds, such as tornados and hurricanes. In addition to other applicable requirements in this code, storm shelters shall be constructed in accordance with ICC/NSSA-500.

## **CHAPTER 4 FOUNDATIONS**

### **SECTION R404 FOUNDATION AND RETAINING WALLS**

**R404.5.2 Precast concrete foundation design drawings.** Precast concrete foundation wall design drawings shall be submitted to the building official and approved prior to installation. Drawings shall include, at a minimum, the following information: *(partial shown)*

7. Basic wind speed.

## **CHAPTER 5 FLOORS**

### **SECTION R505 COLD-FORMED STEEL FLOOR FRAMING**

**R505.1.1 Applicability limits.** *[partial shown]* Cold-formed steel floor framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 139 miles per hour (62 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).

## **CHAPTER 6 WALL CONSTRUCTION**

### **SECTION R602 WOOD WALL FRAMING**

**R602.3 Design and construction.** Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figure s R602.3(1) and R602.3(2), or in accordance with AWC NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing shall be fastened directly to framing members and, where placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in

Table R301.2(2) adjusted for height and exposure using Table R301.2(3) and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703. *[partial shown]*

*Table R602.3(1). Provides the fastening schedule for wood wall framing.*

*Table R602.3(2). Provides alternate attachments to Table R602.3(1)*

*Table R602.3(3). Provides the requirements for wood structural panel wall sheathing used to resist wind pressures.*

*Table R602.3(4). Provides allowable spans for particleboard wall sheathing.*

**R602.3.1 Stud size, height and spacing.** The size, height and spacing of studs shall be in accordance with Table R602.3(5).

**Exceptions:**

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls.
2. Where snow loads are less than or equal to 25 pounds per square foot (1.2 kPa), and the ultimate design wind speed is less than or equal to 130 mph (58.1 m/s), 2-inch by 6-inch (38 mm by 14 mm) studs supporting a roof load with not more than 6 feet (1829 mm) of tributary length shall have a maximum height of 18 feet (5486 mm) where spaced at 16 inches (406 mm) on center, or 20 feet (6096 mm) where spaced at 12 inches (304.8 mm) on center. Studs shall be minimum No. 2 grade lumber.

*Table R602.3(5). Provides size, height and spacing of wood studs.*

**R602.3.5 Braced wall panel uplift load path.** Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
  - 1.1. The ultimate design wind speed does not exceed 115 mph (51 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less.
  - 1.2. The net uplift value at the top of a wall does not exceed 100 plf (146 N/mm). The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing approved uplift framing connectors to provide a continuous load path

from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2.

3. Wall sheathing and fasteners designed to resist combined uplift and shear forces in accordance with accepted engineering practice.

**R602.10.1.3 Spacing of braced wall lines.** The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3. Intermediate braced wall lines through the interior of the building shall be permitted.

*Table R602.10.3. Provides braced wall line spacing for wind.*

**R602.10.2.1 Braced wall panel uplift load paths.** The bracing lengths in Table 602.10.3(1) apply only when uplift loads are resisted in accordance with Section 602.3.5.

*Table R602.10.3(1). Provides bracing requirements based on wind speed.*

**R602.10.3 Required length of bracing.** The required length of bracing along each braced wall line shall be determined as follows:

1. All buildings in Seismic Design Categories A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in Seismic Design Category C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.
4. All buildings in Seismic Design Categories D0, D1 and D2 shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.

Only braced wall panels parallel to the braced wall line shall contribute toward the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the braced wall line as shown in Figure R602.10.1.4. Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner.

**Exception:** The length of wall bracing for dwellings in Seismic Design Categories D0, D1 and D2 with stone or masonry veneer installed in accordance with Section R703.8 and exceeding the first-story height shall be in accordance with Section R602.10.6.5

*Table R602.10.3(2). Provides wind adjustment factors to the required length of wall bracing.*

#### **R602.10.4.1 [Construction methods for braced wall panels] Mixing methods.**

Mixing of bracing methods shall be permitted as follows: *[partial shown]*

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from braced wall line to braced wall line within a story shall be permitted. In regions within Seismic Design Categories A, B and C where the ultimate design wind speed is less than or equal to 130 mph (58m/s), mixing of intermittent bracing and continuous sheathing methods from braced wall line to braced wall line within a story shall be permitted.

**R602.10.5 Minimum length of braced wall panel.** The minimum length of a braced wall panel shall comply with Table R602.10.5 *[partial shown]*

*Table R602.10.5. Provides minimum length of braced wall panels.*

#### **R602.10.6.1 [Construction of methods ABW, PFH, PFG, CS-PF and BV-WSP]**

**<sup>1</sup>Method ABW: Alternate braced wall panels.** The hold-down force shall be in accordance with Table R602.10.6.1. *[partial shown]*

*Table R602.10.6.1. Provides minimum hold-down forces for method ABW braced wall panels.*

#### **R602.10.6.4 [Construction of methods ABW, PFH, PFG, CS-PF and BV-WSP]**

**Method ABW: Continuously sheathed portal frame.** Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4. The number of continuously sheathed portal frame panels in a single braced wall line shall not exceed four.

*Figure R602.10.6.4. Provides details for methods CS-PF, continuously sheathed portal frame panel construction.*

*Table R602.10.6.4. Provides tension strap capacity for resisting wind pressures perpendicular to methods PFH, PFG, and CS-PF braced wall panels.*

#### **R602.10.6.5.1 [Construction of methods ABW, PFH, PFG, CS-PF and BV-WSP]**

**Length of bracing.** The length of bracing along each braced wall line shall be the greater of that required by the ultimate design wind speed and braced wall line spacing in accordance with Table R602.10.3(1) as adjusted by the factors in Table R602.10.3(2) or the seismic design category and braced wall line length in accordance with Table R602.10.6.5. *[partial shown]*

**R602.12 Simplified wall bracing.** Buildings meeting all of the conditions listed below shall be permitted to be braced in accordance with this section as an alternate to the requirements of Section R602.10. The entire building shall be braced in accordance

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<sup>1</sup> ABW: Alternate Braced Wall, PFH: Portal Frame with Hold-downs, CS-PF: Continuously Sheathed Portal Frame, BV-WSP: Wood Structural Panels with Stone or Masonry Veneer



with this section; the use of other bracing provisions of Section R602.10, except as specified herein, shall not be permitted. *[partial shown]*

6. The structure shall be located where the ultimate design wind speed is less than or equal to 130 mph (58 m/s), and the exposure category is B or C.

**R602.12.4 [Simplified wall bracing] Number of bracing units.** Each side of the circumscribed rectangle, as shown in Figure R602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table R602.12.4 placed on the parallel exterior walls facing the rectangle. *[partial shown]*

*Figure R602.12. Provides criteria for a rectangle circumscribing an enclosed building.*

*Table R602.12.4. Provides minimum number of bracing units on each side of the circumscribed rectangle.*

## **SECTION R603 COLD-FORMED STEEL WALL FRAMING**

**R603.3.1 Wall to foundation or floor construction.** Cold-formed steel framed walls shall be anchored to foundation or floors in accordance with Table R603.3.1 and Figure R603.3.1(1), R603.3.1(2), R603.3.1(3) or R603.3.1(4). *[partial shown]*

*Table R603.3.1. Provides wall to foundation or floor connection requirements.*

*Figures R603.3.1(1) – R603.3.1(4). Provide wall connection details.*

**R603.3.1.1 Gable endwalls.** Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Table R603.3.1(1) or R602.3.3.1.1(2).

*Tables R603.3.1.(1) and R603.3.1(2). Provide gable endwall to floor and foundation connection requirements.*

**R603.3.2 Minimum stud sizes.** Cold-formed steel walls shall be constructed in accordance with Figure R603.3.1(1), R603.3.1(2) or R603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16) based upon an ultimate design wind speed of 115 miles per hour (51 m/s), Exposure Category B, and the building width, stud spacing and snow load, as appropriate. Fastening requirements shall be in accordance with Section R603.2.5 and Table R603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs. *[partial shown]*

*Figures R603.3.1.(1), R603.3.1.(2) and R603.3.1.(3). Provide wall to floor and wall to foundation details.*

*Table R603.3.2(1). Provides a wall fastening schedule.*

*Tables R603.3.2(2), (3), (4), (5) and (6). Provides detail on 24, 28, 32, 36 and 40-Foot-Wide building supporting roof and ceiling only.*

*Tables R603.3.2.7(7), (8), (9), (10) and (11). Provides detail on 24, 28, 32, 36 and 40-Foot-Wide building supporting one floor, roof and ceiling.*

*Tables R603.3.2(12), (13), (14), (15) and (16). Provides detail on 24, 28, 32, 36 and 40-Foot-Wide building supporting two floors, roof and ceiling.*

**R603.3.2.1 Gable endwalls.** The size and thickness of gable endwall studs with heights less than or equal to 10 feet (3048 mm) shall be permitted in accordance with the limits set forth in Table R603.3.2.1(1). The size and thickness of gable endwall studs with heights greater than 10 feet (3048 mm) shall be determined in accordance with the limits set forth in Table R603.3.2.1(2)

*Table R603.3.2.1(1). Provides stud size and thickness for all building widths gable endwalls of 8, 9, or 10 feet in height.*

*Table R603.3.2.1(2). Provides stud size and thickness for gable endwalls greater than 10 feet in height.*

*Table R603.3.1.1(1). Provides stud size and thickness for gable endwall to floor connection requirements.*

*Table R603.3.1.1(2). Provides detail on gable endwall bottom track to foundation connection requirements.*

**R603.5 Exterior wall covering.** The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.

**R603.9.2 Determination of minimum length of full-height sheathing.** The minimum length of full-height sheathing on each braced wall line shall be determined by multiplying the length of the braced wall line by the percentage obtained from Table R603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table R603.9.2(2). The minimum length of full-height sheathing shall be not less than 20 percent of the braced wall line length. *[partial shown]*

*Table R603.9.2(1). Provides detail on the minimum percentage of full-height structural sheathing on exterior walls.*

**R603.9.3 Structural sheathing fastening.** Edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure R603.9 and Table R603.3.2(1). Screws for attachment of structural sheathing panels shall be bugle-head, flat-head, or similar head style with a minimum head diameter of 0.29 inch (8 mm). *[partial shown]*

*Figure R603.9. Provides the fastening pattern for structural sheathing.*

**R603.9.4.1 [Uplift connection requirements] Ultimate design wind speeds greater than 126 mph.** Where ultimate design wind speeds exceed 126 miles per hour (56 m/s), Exposure Category C walls shall be provided with direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F7.2, as required for 139 miles per hour (62 m/s), Exposure Category C.

## **SECTION R608 EXTERIOR CONCRETE WALL CONSTRUCTION**

**R608.6.2 [Above-grade wall requirements] Wall reinforcement for wind.** Vertical wall reinforcement for resistance to out-of-plane wind forces shall be determined from Table R608.6(1), R608.6(2), R608.6(3) or R608.6(4).

*Tables R608.6(1), R608.6(2), R608.6(3) and R608.6(4). Provide minimum vertical reinforcement for various types of concrete walls.*

**R608.7.1.1 Length of solid wall for wind.** Buildings shall have solid walls in each exterior endwall line (the side of a building that is parallel to the span of the roof or floor framing) and sidewall line (the side of a building that is perpendicular to the span of the roof or floor framing) to resist lateral in-plane wind forces. The site-appropriate basic wind speed and exposure category shall be used in Tables R608.7(1A) through (1C) to determine the unreduced total length, *UR*; of solid wall required in each exterior endwall line and sidewall line. *[partial shown]*

*Tables R608.7(1A) through (1C). Provide unreduced length of solid wall in endwalls.*

**R608.9.3 Connections between concrete walls and light-framed ceiling and roof systems.** Connections between concrete walls and light-framed ceiling and roof systems shall be in accordance with one of the following: *[partial shown]*

## **SECTION R609 EXTERIOR WINDOWS AND DOORS**

**R609.2 Performance.** Exterior windows and doors shall be designed to resist the design wind loads specified in Table R301.2(2) adjusted for height and exposure in accordance with Table R301.2(3) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *International Building Code*.

**R609.3.1 [Testing and labeling] Comparative analysis.** Structural wind load design pressures for window and door units different than the size tested in accordance with Section R609.3 shall be permitted to be different than the design value of the tested unit where determined in accordance with one of the following comparative analysis methods: *[partial shown]*

**R609.4 Garage doors.** Garage doors shall be tested in accordance with either ASTM E 330 or ANSI/DASMA 108, and shall meet the acceptance criteria of ANSI/DASMA 108.

**R609.5 Other exterior window and door assemblies.** Exterior windows and door assemblies not included within the I scope of Section R609.3 or R609.4 shall be tested in accordance with ASTM E 330. Glass in assemblies covered by this exception shall comply with Section R308.5.

**R609.6 Wind-borne debris protection.** Protection of exterior windows and glass doors in buildings located in windborne debris regions shall be in accordance with Section R301.2.1.2.

**R609.6.1 Fenestration testing and labeling.** Fenestration shall be tested by an *approved* independent laboratory, listed by an *approved* entity, and bear a *label* identifying manufacturer, performance characteristics, and *approved* inspection agency to indicate compliance with the requirements of the following specification(s):

1. ASTM E 1886 and ASTM E 1996; or
2. AAMA506.

**R609.7 Anchorage methods.** The methods cited in this section apply only to anchorage of window and glass door assemblies to the main force-resisting system.

**R609.7.1 Anchoring requirements.** Window and glass door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

**R609.7.2 Anchorage details.** Products shall be anchored in accordance with the minimum requirements illustrated in Figures R609.7.2(1), R609.7.2(2), R609.7.2(3), R609.7.2(4), R609.7.2(5), R609.7.2(6), R609.7.2(7) and R609.7.2(8).

*Figures R609.7.2(1) through R609.7.2(8). Pertain to window and door frame anchorage details.*

## **SECTION R610 STRUCTURAL INSULATED PANEL WALL CONSTRUCTION**

**R610.2 Applicability limits.** *[partial shown]* Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed ( $V_{ult}$ ) is not greater than 155 miles per hour (69 m/s), Exposure B or 140 miles per hour (63 m/s) Exposure C, the ground snow load is not greater than 70 pounds per foot (3.35 kPa), and the seismic design category is A, B or C.

**R610.5 Wall construction.** Exterior walls of SIP construction shall be designed and constructed in accordance with the provisions of this section and Tables R610.5(1) and R610.5(2) and Figures R610.5(1) through R610.5(5). SIP walls shall be fastened to other wood building components in accordance with Tables R602.3(1) through R602.3(4).

Tables R610.5(1) and R610.5(5). Provide minimum wall thickness.

Figures R610.5(1) through R610.5(5). Provide maximum allowable wall height and connection details.

## CHAPTER 7 WALL COVERING

### SECTION R703 EXTERIOR COVERING

**R703.1.2 Wind resistance.** Wall coverings, backing materials and their attachments shall be capable of resisting wind loads in accordance with Tables R301.2(2) and R301.2(3). Wind-pressure resistance of the siding and backing materials shall be determined by ASTM E 330 or other applicable standard test methods. Where wind-pressure resistance is determined by design analysis, data from approved design standards and analysis conforming to generally accepted engineering practice shall be used to evaluate the siding and backing material and its fastening. All applicable failure modes including bending rupture of siding, fastener withdrawal and fastener head pull-through shall be considered in the testing or design analysis. Where the wall covering and the backing material resist wind load as an assembly, use of the design capacity of the assembly shall be permitted.

**R703.3.1 [Nominal Thickness and attachments] Wind limitations.** Where the design wind pressure exceeds 30 psf or where the limits of Table R703.3.1 are exceeded, the attachment of wall coverings shall be designed 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). For the determination of wall covering attachment, component and cladding loads shall be determined using an effective wind area of 10 square feet (0.93 m<sup>2</sup>).

*Table R703.3.1. Limits for attachment per table per table R703.3(1)*

**R703.8.4.1 [Anchorage] Size and spacing. [partial shown]**

**Exception:** In Seismic Design Category D0, D1 or D2 or townhouses in Seismic Design Category C or in wind areas of more than 30 pounds per square foot pressure (1.44 kPa), each tie shall support not more than 2 square feet (0.2 m<sup>2</sup>) of wall area.

**R703.11.2 Foam plastic sheathing. Exception:** Where the foam plastic sheathing is applied directly over wood structural panels, fiberboard, gypsum sheathing or other approved backing capable of independently resisting the design wind pressure, the vinyl siding shall be installed in accordance with Section R703.11.1.

**R703.11.2.1 Basic wind speed not exceeding 115 miles per hour and Exposure Category B.** Where the ultimate design wind speed does not exceed 115 miles per hour (51 m/s), the exposure category is B and gypsum board, gypsum panel product or equivalent is installed on the side of the wall opposite the foam plastic sheathing, the

minimum siding fastener penetration into wood framing shall be 1 1/4 inches (32 mm) using minimum 0.120-inch-diameter (3 mm) nail (shank) with a minimum 0.313-inch-diameter head, 16 inches (406 mm) on center. The foam plastic sheathing shall be minimum 1/2-inch-thick (12.7 mm) (nominal) extruded polystyrene in accordance with ASTM C 578, 1/2-inch-thick (12.7 mm) (nominal) polyisocyanurate in accordance with ASTM C 1289 or 1-inch-thick (25 mm) (nominal) expanded polystyrene in accordance with ASTM C 578.

**R703.11.2.2 Basic wind speed exceeding 115 miles per hour or Exposure Categories C and D.** Where the ultimate design wind speed exceeds 115 miles per hour (51 m/s), the exposure category is C or D, or all conditions of Section R703.11.2.1 are not met, the adjusted design pressure rating for the assembly shall meet or exceed the loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3). The design wind pressure rating of the vinyl siding for installation over solid sheathing as provided in the vinyl siding manufacturer's product specifications shall be adjusted for the following wall assembly conditions:

1. For wall assemblies with foam plastic sheathing on the exterior side and gypsum wall board, gypsum panel product or equivalent on the interior side of the wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.39.
2. For wall assemblies with foam plastic sheathing on the exterior side and without gypsum wall board, gypsum panel product or equivalent on the interior side of wall, the vinyl siding's design wind pressure rating shall be multiplied by 0.27.

## **CHAPTER 8 ROOF-CEILING CONSTRUCTION**

### **SECTION R802 WOOD ROOF FRAMING**

**R802.10.2.1 [Wood trusses] Applicability limits.** The provisions of this section shall control the design of truss roof framing when snow controls for buildings, not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span, not more than three stories above grade plane in height, and roof slopes not smaller than 3:12 (25 percent slope) or greater than 12:12 (100-percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 140 miles per hour (63 m/s), Exposure B or C, and a maximum ground snow load of 70 psf (3352 Pa). For consistent loading of all truss types, roof snow load is to be computed as: 0.7 pg.

**R802.11.1 [Roof tie-down] Uplift resistance.** Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1.1 and R802.11.1.2.

Where the uplift force does not exceed 200 pounds (90.8 kg), rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1).

Where the basic wind speed does not exceed 115 mph, the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, rafters and trusses spaced not more than 24 inches (610 mm) on center shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3 (1).

**R802.11.1.1 Truss uplift resistance.** Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the truss design drawings for the ultimate design wind speed as determined by Figure R301.2(4)A and listed in Table R301.2(1) or as shown on the construction documents. Uplift forces shall be permitted to be determined as specified by Table R802.11, if applicable, or as determined by accepted engineering practice.

*Table R802.11. Provides for rafter or truss uplift connection forces from wind.*

**R802.11.1.2 Rafter uplift resistance.** Individual rafters shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as determined by Table R802.11 or as determined by accepted engineering practice. Connections for beams used in a roof system shall be designed in accordance with accepted engineering practice.

## **SECTION R804 COLD-FORMED STEEL ROOF FRAMING**

**R804.1.1 Applicability limits.** The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist span or truss, less than or equal to three stories above grade plane and with roof slopes not less than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 139 miles per hour (62 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3350 Pa).

**R804.3 Roof construction.** Cold-formed steel roof systems constructed in accordance with the provisions of this section shall consist of both ceiling joists and rafters in accordance with Figure R804.3 and fastened in accordance with Table R804.3.

*Figure 804.3. Illustrates cold-formed steel roof construction.*

*Table R804.3. Provides the roof framing fastening schedule.*

**R804.3.2.1 Minimum roof rafter sizes.** *[partial shown]*

For the purpose of determining roof rafter sizes in Table R804.3.2.1(1), ultimate design wind speeds shall be converted to equivalent ground snow loads in accordance with Table R804.3.2.1(2). Roof rafter sizes shall be based on the higher of the ground snow load or the equivalent snow load converted from the ultimate design wind speed.

*Table R804.3.2.1(1). Provides the allow roof rafter span for snow loads.*

*Table R804.3.2.1(2). Provides the ultimate design wind speed to equivalent snow load conversion.*

**R804.3.7.1 Ceiling diaphragms.** At gable endwalls a ceiling diaphragm shall be provided by attaching a minimum 1/2-inch (12.7 mm) gypsum board or a minimum 3/8-inch (9.5 mm) wood structural panel sheathing, that complies with Section R803, to the bottom of ceiling joists or roof trusses and connected to wall framing in accordance with Figures R804.3.7.1(1) and R804.3.7.1(2), unless studs are designed as full height without bracing at the ceiling. Flat blocking shall consist of C-shaped or track section with a minimum thickness of 33 mils (0.84 mm). For a gypsum board sheathed ceiling, the diaphragm length shall be in accordance with Table R804.3.7.1. For a wood structural panel sheathed ceiling, the diaphragm length shall be not less than 12 feet (3658 mm) for building widths less than 36 feet (10 973 mm), or not less than 14 feet (4267 mm) for building widths greater than or equal to 36 feet (10 973 mm).

The ceiling diaphragm shall be secured with screws spaced at a maximum 6 inches (152 mm) o.c. at panel edges and a maximum 12 inches (305 mm) o.c. in the field. The required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms shall be permitted to be multiplied by 0.35 if all panel edges are blocked. Multiplying the required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms by 0.9 shall be permitted if all panel edges are secured with screws spaced at 4 inches (102 mm) o.c.

*Table R804.3.7.1. Provides the required lengths for ceiling diaphragms at gable endwalls gypsum board sheathed, with a ceiling height of 8 feet.*

## CHAPTER 9 ROOF ASSEMBLIES

### SECTION R905 REQUIREMENTS FOR ROOF COVERINGS

**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 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).

**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 and metal roof panels shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D 226, D



1970, D 4869 and D 6757 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). *[partial shown]*

*Table 905.1.1(1). Provides the underlayment types and maximum design wind speed.*

*Table 905.1.1(2). Provides the underlayment application for maximum design wind speed.*

*Table R905.1.1(3). Provides the underlayment attachment per design wind speed.*

**R905.2.4.1 Wind resistance of asphalt shingles.** Asphalt shingles shall be tested in accordance with ASTM D 7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D 7158 and the required classification in Table R905.2.4.1.

**Exception:** Asphalt shingles not included in the scope of ASTM D 7158 shall be tested and labeled to indicate compliance with ASTM D 3161 and the required classification in Table R905.2.4.1.

*Table R905.2.4.1. Provides classification of asphalt roof shingles.*

**R905.3.7 [Clay and concrete tile] Application.** *[partial shown]* Clay and concrete roof tiles shall be fastened in accordance with this section and the manufacturer's installation instructions. Perimeter tiles shall be fastened with not less than one fastener per tile. Tiles with installed weight less than 9 pounds per square foot (0.4 kg/m<sup>2</sup>) require not less than one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer's installation instructions where applied in areas where the ultimate design wind speed exceeds 130 miles per hour (58 m/s) and on buildings where the roof is located more than 40 feet (12 192 mm) above grade. In areas subject to snow, not less than two fasteners per tile are required. In other areas, clay and concrete roof tiles shall be attached in accordance with Table R905.3.7.

*Table R905.3.7. Provides the clay and concrete tile attachment.*

**R905.4.5 [Metal roof shingles] Application.** Metal roof shingles shall be secured to the roof in accordance with this chapter and the *approved* manufacturer's installation instructions.

**R905.10.4 [Metal roof panels] Attachment.** Metal roof panels shall be secured to the supports in accordance with this chapter and the manufacturer's installation instructions. In the absence of manufacturer's installation instructions, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.

2. Copper, brass, bronze, copper alloy and 300-series stainless steel fasteners shall be used for copper roofs.
3. Stainless steel fasteners are acceptable for metal roofs.

**R905.16.4.2 Underlayment and high winds.** Underlayment applied in areas subject to high winds [above 140 mph (63m/s), in accordance with Figure R301.2(4)A] shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's installation instructions. Fasteners are to be applied along the overlap not farther apart than 36 inches (914 mm) on center.

Underlayment installed where the ultimate design wind speed equals or exceeds 150 mph (67m/s) shall comply with ASTM D 4869 Type IV, or ASTM D 6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. Underlayment shall be applied as required for asphalt shingles in accordance with Table R905.1.1(2). Underlayment shall be attached using metal or plastic cap nails with a head diameter of not less than 1 inch (25 mm) with a thickness of not less than 32-gage sheet metal. The cap-nail shank shall be not less than 12 gage (0.105 inches) with a length to penetrate through the roof sheathing or not less than <sup>3</sup>/<sub>4</sub> inch (19 mm) into the roof sheathing.

**Exception:** As an alternative, adhered underlayment complying with ASTM D 1970 shall be permitted.

**R905.16.7 Wind resistance.** 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 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 D 3161 and the required classification from Table R905.2.4.1.

## **SECTION R905 ROOFTOP-MOUNTED PHOTOVOLTAIC SYSTEMS**

**R907.2 Wind resistance.** Rooftop-mounted photovoltaic panel or modules systems 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).

## **CHAPTER 44 REFERENCED STANDARDS**

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section R102.4.

<b>Standard Reference Number</b>	<b>Title</b>	<b>Referenced in Code Section Number</b>
ASTM	ASTM International	100 Barr Harbor Drive West Conshohocken, PA 19428
D 7158-D 7158M-2011	Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method)	R905.2.4.1, Table R905.2.4.1
DASMA	Door and Access Systems Manufacturers Association International	1300 Summer Avenue Cleveland, OH 44115-2851
115-12	Standard Method for Testing Garage Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	R301.2.1.2
ICC	International Code Council, Inc.	500 New Jersey Avenue, NW 6th Floor Washington, DC 20001
ICC 600-14	Standard for Residential Construction in High-wind Regions	R301.2.1.1
ICC 500-14	ICC/NSSA Standard on the Design and Construction of Storm Shelters	R323.1
SBCA	Structural Building Components Association	6300 Enterprise Lane Madison, WI 53719
FS100-12	Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies	R316.8

**APPENDIX E  
MANUFACTURED HOUSING USED AS DWELLINGS**

**SECTION AE602  
PIER CONSTRUCTION**

**AE602.1 General.** Piers shall be designed and constructed to distribute loads evenly. Multiple-section homes may have concentrated roof loads which will require special consideration. Load-bearing piers may be constructed utilizing one of the following methods listed. Such piers shall be considered to resist only vertical forces acting in a downward direction. They shall not be considered as providing any resistance to horizontal loads induced by wind or earthquake forces. *[partial shown]*

**SECTION AE605  
TIES, MATERIALS AND INSTALLATION**

**AE605.1 General.** *[partial shown]* The minimum number of ties required per side shall be sufficient to resist the wind load stated in this code. Ties shall be as evenly spaced as practicable along the length of the manufactured home with the distance from each end of the home and the tie nearest that end not exceeding 8 feet (2438 mm). When continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, both ties may be connected to a single anchor, provided the anchor used is capable of carrying both loads. Multiple-section manufactured homes require diagonal ties only. Diagonal ties shall be installed on the exterior main frame and slope to the exterior at an angle of 40 to 50 degrees from the vertical or within the angle limitations specified by the home manufacturer. Vertical ties which are not continuous over the top of the manufactured home shall be attached to the main frame.

**APPENDIX H  
PATIO COVERS**

**SECTION AH105  
STRUCTURAL PROVISIONS**

**AH105.1 Design loads.** Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a vertical live load of not less than 10 pounds per square foot (0.48 kN/m<sup>2</sup>), except that snow loads shall be used where such snow loads exceed this minimum. Such covers shall be designed to resist the minimum wind loads set forth in Section R301.2.1.

**SECTION AH106  
SPECIAL PROVISIONS FOR ALUMINUM SCREEN ENCLOSURES IN  
HURRICANE-PRONE REGIONS**

**AH106.1 General.** Screen enclosures in hurricane-prone regions shall be in accordance with the provisions of this section.

**AH106.2 Definition.** The following word and term shall, for the purposes of this appendix, have the meaning shown herein.

**SCREEN ENCLOSURE.** A building or part thereof, in whole or in part self-supporting, and having walls of insect screening, and a roof of insect screening, plastic, aluminum or similar lightweight material.

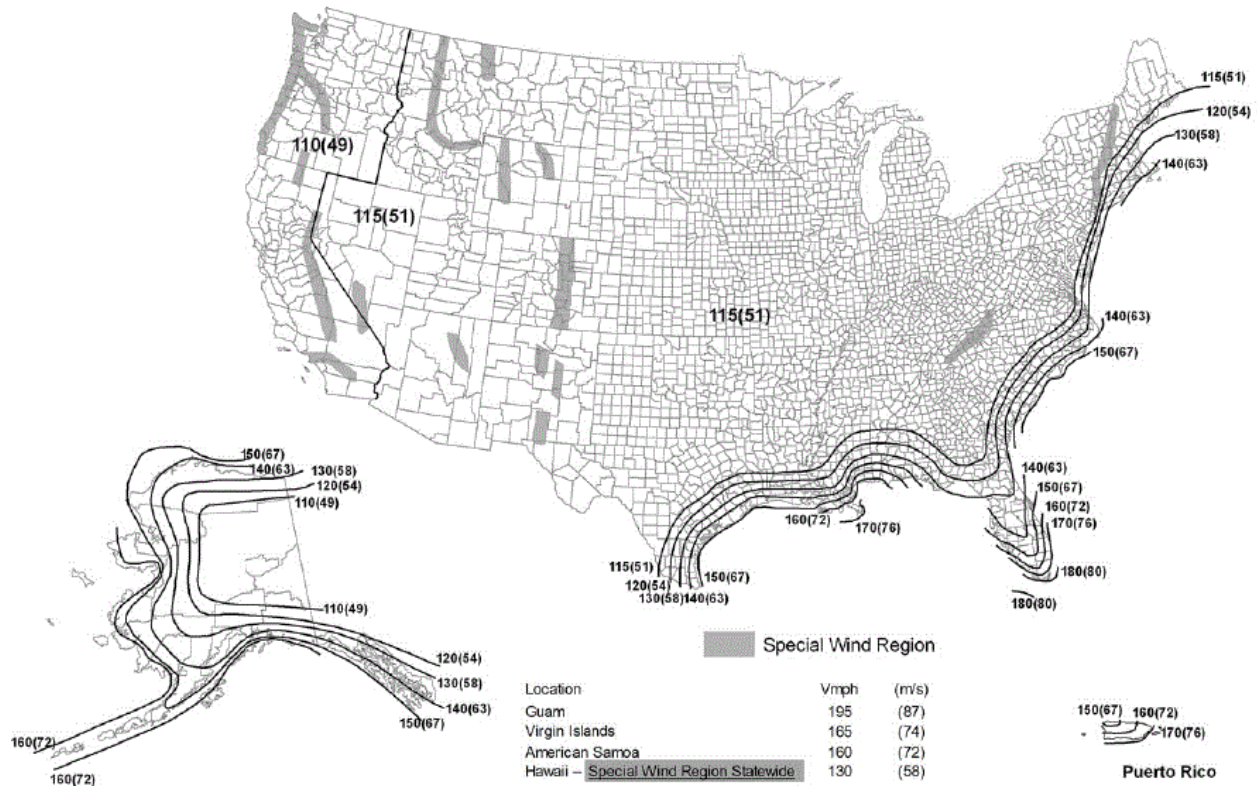
**AH106.3 Screen enclosures.** Screen enclosures shall comply with Sections AH106.3.1 and AH106.3.2. *[partial shown]*

**AH106.4 Design.** The structural design of screen enclosures shall comply with Sections AH106.4.1 through AH106.4.3.

**AH106.4.1 Wind load.** Structural members supporting screen enclosures shall be designed to support the minimum wind loads given in Tables AH106.4(1) and AH106.4(2) for the ultimate design wind speed,  $V_{ult}$ , determined from Figure AH106.4.1. Where any value is less than 10 pounds per square foot (psf) (0.479 kN/m<sup>2</sup>) use 10 pounds per square foot (0.479 kN/m<sup>2</sup>).

*Table AH106.4(1). Provides the design wind pressures for screen enclosure framing.*

*Table AH106.4(2). Provides the adjustment factor for building height and exposure.*



- 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 between contours is permitted.
  3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
  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).

**FIGURE AH106.4.1. ULTIMATE DESIGN WIND SPEEDS FOR PATIO COVERS AND SCREEN ENCLOSURES**

**APPENDIX R  
LIGHT STRAW-CLAY CONSTRUCTION**

**SECTION AR103  
NONBEARING LIGHT STRAW-CLAY CONSTRUCTION**

**AR103.2.2 [Structure] Bracing.** Wind bracing shall be in accordance with Section R602.10 and shall use Method LIB. Walls with light straw-clay infill shall not be sheathed with solid sheathing.

**APPENDIX S  
STRAWBALE CONSTRUCTION**

**SECTION AS102  
DEFINITIONS**

**SHEAR WALL.** A strawbale wall designed and constructed to resist lateral seismic and wind forces parallel to the plane of the wall in accordance with Section AS106.13.

**SECTION AS105  
STRAWBALE WALLS—GENERAL**

**AS105.4.1 [Out of plane resistance and unrestrained wall dimensions]**

**Determination of out-of-plane loading.** Out-of-plane loading for the use of Table AS105.4 shall be in terms of the design wind speed and seismic design category as determined in accordance with Sections R301.2.1 and R301.2.2 of this code.

*Table AS105.4.Provides the out-of-plane resistance and unrestrained wall dimensions.*

\* \* \* \* \*